MOTOROLA SOLUTIONS

APX™ P25 Mobile Radio

APX 8500 Installation Manual

JANUARY 2025

MN003109A01-AJ

Contents

List of Figures

List of Tables

Foreword

This manual covers the O2, O3, O5, E5, O7, and O9 models of the ASTRO® APX 8500™ mobile radios. It includes all the information necessary to install mid and high power radios and configure radio installation inside vehicles.

For details on radio operation or component-level troubleshooting, refer to the applicable manuals available separately. A list of related publications is provided in the Related Publications on page 16 section.

Intellectual Property and Regulatory Notices

Copyrights

The Motorola Solutions products described in this document may include copyrighted Motorola Solutions computer programs. Laws in the United States and other countries preserve for Motorola Solutions certain exclusive rights for copyrighted computer programs. Accordingly, any copyrighted Motorola Solutions computer programs contained in the Motorola Solutions products described in this document may not be copied or reproduced in any manner without the express written permission of Motorola Solutions.

No part of this document may be reproduced, transmitted, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without the prior written permission of Motorola Solutions, Inc.

Trademarks

MOTOROLA, MOTO, MOTOROLA SOLUTIONS, and the Stylized M Logo are trademarks or registered trademarks of Motorola Trademark Holdings, LLC and are used under license. All other trademarks are the property of their respective owners.

License Rights

The purchase of Motorola Solutions products shall not be deemed to grant either directly or by implication, estoppel or otherwise, any license under the copyrights, patents or patent applications of Motorola Solutions, except for the normal nonexclusive, royalty-free license to use that arises by operation of law in the sale of a product.

Open Source Content

This product may contain Open Source software used under license. Refer to the product installation media for full Open Source Legal Notices and Attribution content.

European Union (EU) and United Kingdom (UK) Waste of Electrical and Electronic Equipment (WEEE) Directive

The European Union's WEEE directive and the UK's WEEE regulation require that products sold into EU countries and the UK must have the crossed-out wheelie bin label on the product (or the package in some cases. As defined by the WEEE directive, this crossed-out wheelie bin label means that customers and end users in EU and UK countries should not dispose of electronic and electrical equipment or accessories in household waste.

Customers or end users in EU and UK countries should contact their local equipment supplier representative or service center for information about the waste collection system in their country.

Disclaimer

Please note that certain features, facilities, and capabilities described in this document may not be applicable to or licensed for use on a specific system, or may be dependent upon the characteristics of a specific mobile subscriber unit or configuration of certain parameters. Please refer to your Motorola Solutions contact for further information.

Document History

The following major changes have been implemented in this manual since the previous edition:

Table 1: Document History

Version	Description	Date
MN003109A01-AA	Initial release.	January 2017
MN003109A01-AB	Added high power radio information.	August 2018
MN003109A01-AC	Updated Introduction on page 22 to add in information regarding additional equipment required to assure optimal performance between the APX™ 8500 and DVR/VRX1000.	September 2018
MN003109A01-AD	Added E5 Control Head information	June 2020
MN003109A01-AE	Added Motorola Solutions Range Extension Connection to APX8500 on page 103	May 2021
MN003109A01-AF	Added images Mid Power Ethernet Faceplate • Figure 13: Front View of Mid Power Ethernet Faceplate and Trunnion on page 28 • Figure 14: Side View of Mid Power Ethernet Faceplate and Trunnion on page 28 • Dust Cover Installation on page 140	August 2021
MN003109A01-AG	Added in J2 Mid Power Transceiver – Data and Audio Rear Interface on page 88	December 2021
MN003109A01-AH	Added French (Canada) language.	August 2024
MN003109A01-AJ	Updated the Radio Mounting on page 50 to add in information when using the Impact Detection feature.	January 2025

Notations Used in This Manual

Throughout the text in this publication, you may notice the use of warning, caution, and note notations. These notations are used to emphasize that safety hazards exist, and due care must be taken and observed.

WARNING: WARNING indicates a potentially hazardous situation, which, if not avoided, could result in death or injury.

CAUTION: CAUTION indicates a potentially hazardous situation, which, if not avoided, might result in equipment damage.

NOTE: NOTE indicates an operational procedure, practice, or condition that is essential to emphasize.

Related Publications

The following list contains part numbers and titles of related publications.

- 68012006035, *ASTRO APX Mobile Radio O2 Control Head User Guide*
- 6875946M01, *ASTRO APX Mobile Radio O3 Control Head User Guide*
- 6875947M01, *ASTRO APX Mobile Radio O5 Control Head User Guide*
- 68012006034, *ASTRO APX Mobile Radio O7 Control Head User Guide*
- 68007024014, *ASTRO APX Mobile Radio O9 Control Head User Guide*
- MN006147A01, *ASTRO APX Mobile Radio E5 Control Head User Guide*
- MN003076A01, *ASTRO APX Mobile Radio Basic Service Manual*
- PMLN6193, *ASTRO APX Mobile Radio O2 Quick Reference Card*
- PMLN5591, *ASTRO APX Mobile Radio O3 Quick Reference Card*
- PMLN5592, *ASTRO APX Mobile Radio O5 Quick Reference Card*
- PMLN6194, *ASTRO APX Mobile Radio O7 Quick Reference Card*
- PMLN5711, *ASTRO APX Mobile Radio O9 Quick Reference Card*
- MN006146A01, *ASTRO APX Mobile Radio E5 Quick Reference Card (EMEA)*
- MN006240A01, *ASTRO APX Mobile Radio E5 Quick Reference Card (NALA)*
- 6881095C99/NNTN7851, *ASTRO APX Mobile Safety Manual*
- MN001435A01/PMLN7688, *ASTRO APX Wi-Fi Provisioning Leaflet*
- 6881095C99, *RF Energy ExposureTraining and Product Safety Information for Mobile Two-Way Radios installed in Vehicles or as Fixed Site Control Stations*
- MN000770A01, *Dual-radio Control Head System Instruction Manual*

Commercial Warranty

Limited Warranty

For information on warranty terms, see the Support page at https://www.motorolasolutions.com.

I. What This Warranty Covers And For How Long

Motorola Solutions Inc. ("Motorola Solutions") warrants the Motorola Solutions manufactured Communication Products listed below ("Product") against defects in material and workmanship under normal use and service for a period of time from the date of purchase as scheduled below:

Portable Radios	Please refer to the warranty statement of your region.
Product Accessories (Excluding Batteries and Chargers)	One Year

Mobile Radios	One Year
Product Accessories	One Year

The radios additionally ship with a standard 1-year Repair Service Advantage (RSA) (for U.S. customers) or 1-year Extended Warranty (for Canada customers). However, at the time of order, you may choose to omit these warranties. For more RSA or Extended Warranty information, please refer to the price pages.

Motorola Solutions, at its option, will at no charge either repair the Product (with new or reconditioned parts), replace it (with a new or reconditioned Product), or refund the purchase price of the Product during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts of Product shall become the property of Motorola Solutions.

This express limited warranty is extended by Motorola Solutions to the original end user purchaser only and is not assignable or transferable to any other party. This is the complete warranty for the Product manufactured by Motorola Solutions. Motorola Solutions assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of Motorola Solutions. Unless made in a separate agreement between Motorola Solutions and the original end user purchaser, Motorola Solutions does not warrant the installation, maintenance or service of the Product.

Motorola Solutions cannot be responsible in any way for any ancillary equipment not furnished by Motorola Solutions which is attached to or used in connection with the Product, or for operation of the Product with any ancillary equipment, and all such equipment is expressly excluded from this warranty. Because each system which may use the Product is unique, Motorola Solutions disclaims liability for range, coverage, or operation of the system as a whole under this warranty.

II. General Provisions

This warranty sets forth the full extent of Motorola Solutions responsibilities regarding the Product. Repair, replacement or refund of the purchase price, at Motorola Solutions option, is the exclusive remedy.

This warranty is given in lieu of all other express warranties, implied warranties, including without limitation, implied warranties of merchantability and fitness for a particular purpose, are limited to the duration of this

limited warranty. In no event shall Motorola Solutions be liable for damages in excess of the purchase price of the product, for any loss of use, loss of time, inconvenience, commercial loss, lost profits or savings or other incidental, special or consequential damages arising out of the use or inability to use such product, to the full extent such may be disclaimed by law.

III. State Law Rights (Applicable Only in U.S.A.)

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitation on how long an implied warranty lasts, so the above limitation or exclusions may not apply.

This warranty gives specific legal rights, and there may be other rights which may vary from state to state.

IV. How To Get Warranty Service

You must provide proof of purchase (bearing the date of purchase and Product item serial number) in order to receive warranty service and, also, deliver or send the Product item, transportation, and insurance prepaid, to an authorized warranty service location.

Warranty service will be provided by Motorola Solutions through one of its authorized warranty service locations. If you first contact the company which sold you the Product, it can facilitate your obtaining warranty service.

You can also call Motorola Solutions at 1-800-927-2744 US/Canada.

V. What This Warranty Does Not Cover

This warranty does not cover the following conditions:

- Defects or damage resulting from use of the Product in other than its normal and customary manner.
- Defects or damage from misuse, accident, water, or neglect.
- Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.
- Breakage or damage to antennas unless caused directly by defects in material workmanship.
- A Product subjected to unauthorized Product modifications, disassemblies or repairs (including, without limitation, the addition to the Product of non-Motorola Solutions supplied equipment) which adversely affect performance of the Product or interfere with Motorola Solutions normal warranty inspection and testing of the Product to verify any warranty claim.
- Product which has had the serial number removed or made illegible.
- Rechargeable batteries if:
  - Any of the seals on the battery enclosure of cells are broken or show evidence of tampering.
  - The damage or defect is caused by charging or using the battery in equipment or service other than the Product for which it is specified.
- Freight costs to the repair depot.
- A Product which, due to illegal or unauthorized alteration of the software/firmware in the Product, does not function in accordance with Motorola Solutions published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from Motorola Solutions.
- Scratches or other cosmetic damage to Product surfaces that does not affect the operation of the Product.
- Normal and customary wear and tear.

VI. Patent And Software Provisions

Motorola Solutions will defend, at its own expense, any suit brought against the end user purchaser to the extent that it is based on a claim that the Product or parts infringe a United States patent, and Motorola Solutions will pay those costs and damages finally awarded against the end user purchaser in any such suit which are attributable to any such claim.

But such defense and payments are conditioned on the following:

- Motorola Solutions will be notified promptly in writing by such purchaser of any notice of such claim.
- Motorola Solutions will have sole control of the defense of such suit and all negotiations for its settlement or compromise.
- Product or parts become, or in Motorola Solutions opinion be likely to become, the subject of a claim of infringement of a United States patent, that such purchaser will permit Motorola Solutions, at its option and expense, either to procure for such purchaser the right to continue using the Product or parts or to replace or modify the same so that it becomes noninfringing or to grant such purchaser a credit for the Product or parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or parts as established by Motorola Solutions.

Motorola Solutions will have no liability with respect to any claim of patent infringement which is based upon the combination of the Product or parts furnished hereunder with software, apparatus or devices not furnished by Motorola Solutions, nor will Motorola Solutions have any liability for the use of ancillary equipment or software not furnished by Motorola Solutions which is attached to or used in connection with the Product. The foregoing states the entire liability of Motorola Solutions with respect to infringement of patents by the Product or any parts thereof.

Laws in the United States and other countries preserve for Motorola Solutions certain exclusive rights for copyrighted Motorola Solutions software such as the exclusive rights to reproduce in copies and distribute copies of such Motorola Solutions software. Motorola Solutions software may be used in only the Product in which the software was originally embodied and such software in such Product may not be replaced, copied, distributed, modified in any way, or used to produce any derivative thereof. No other use including, without limitation, alteration, modification, reproduction, distribution, or reverse engineering of such Motorola Solutions software or exercise of rights in such Motorola Solutions software is permitted. No license is granted by implication, estoppel or otherwise under Motorola Solutions patent rights or copyrights.

VII. Governing Law

This Warranty is governed by the laws of the State of Illinois, USA.

Installation Requirements for Compliance with Radio Frequency (RF) Energy Exposure Safety Standards

ATTENTION: This radio is intended for use in occupational/controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to meet FCC limits. This radio device is NOT authorized for general population, consumer, or any other use.

To ensure compliance to RF Energy Safety Standards:

- Install only Motorola Solutions approved antennas and accessories.
- Be sure that antenna installation is per Antenna Installation on page 68 of this manual.
- Be sure that the Product Safety and RF Safety Booklet enclosed with this radio is available to the end user upon completion of the installation of this radio.

Before using this product, read the guide enclosed with your radio which contains important operating instructions for safe usage and RF energy awareness and control for compliance with applicable standards and regulations.

For a list of Motorola Solutions-approved antennas and other accessories, visit http://www.motorolasolutions.com.

WARNING: This equipment is compliant with Class A of EN55032. In a residential environment, this equipment may cause radio interference.

Chapter 1

Introduction

This manual covers the installation procedures for ASTRO APX 8500 mobile and motorcycle radios with O2, O3, O5, E5, O7, and O9 control heads, and accessories required to complete the radio system.

The radio system consists of the followings:

- Control head
- Radio
- Antenna
- Microphone
- Speaker
- Cabling
- Universal Relay Controller (URC)
- Accessories

APX Mobile high power does not support motorcycle radios.

NOTE:
Depending on the equipment installation and frequency usage, additional equipment may be required to assure optimal performance between the APX™ 8500 and DVR/VRX1000. When using an APX 8500 with an antenna (all band or with a triplexer) that includes the same frequency range as the DVRS/VXR1000, this additional equipment helps to assure the preferred performance between these two products.

This addresses all new sales that combine an APX 8500 with a DVR/VRX1000 and any replacements of an existing Mobile Subscriber Unit (MSU) with the APX 8500 where the DVR/VRX1000 may already be deployed.

For more information, contact Futurecom (sales@futurecom.com). Provide the following information to assist the Futurecom sales to assess a particular configuration:

1. MSU band(s) and frequencies if known
2. DVR/VRX1000 frequencies
3. If in-band operation is disabled
4. Antenna type (single band vs all band)

Supplemental form: http://www.futurecom.com/upl/downloads/catalog/products/supplemental-ordering-form-51a33dfb.pdf.

1.1 Mobile Radio Description

This chapter covers the basic dimension of the mobile radio.

1.1.1

Dimensions

When installing the radio, plan the installation carefully and leave room for cabling and accessory connections in the installed location and to the sides and top of the radio for the installation of the radio into the trunnion with the appropriate hardware.

NOTE: The measurement unit used is millimeter unless otherwise stated.

Figure 1: Front View of O2 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

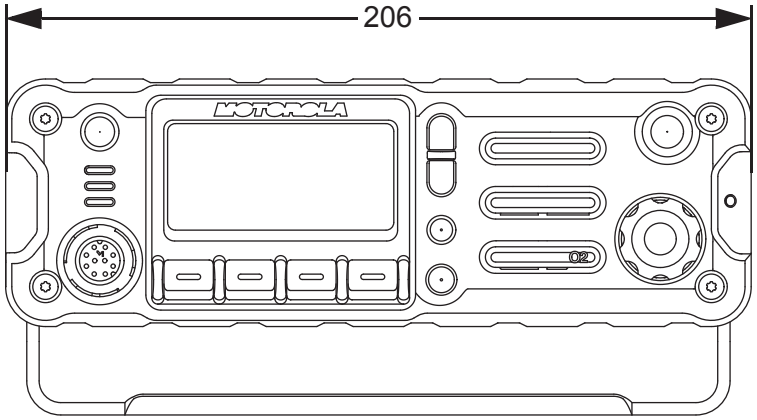


Figure 2: Side View of O2 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

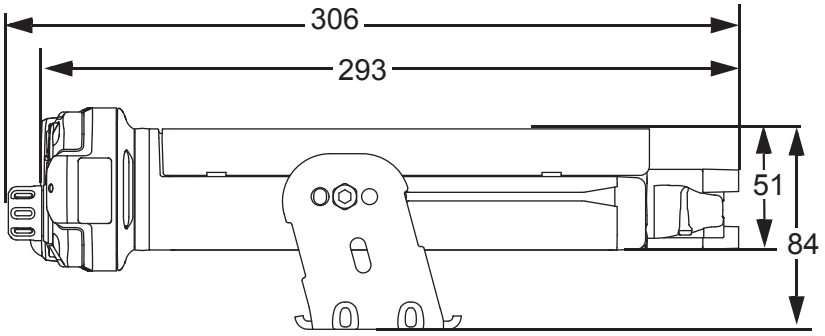


Figure 3: Front View of O3 Control Head with Coiled Cable

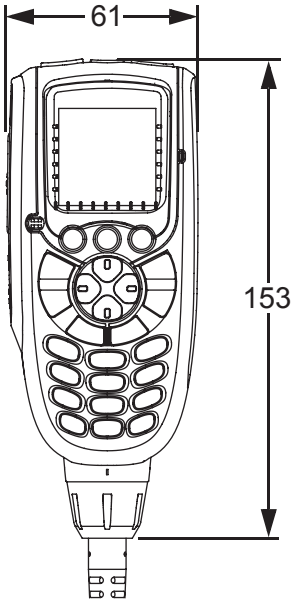


Figure 4: Side View of O3 Control Head with Coiled Cable

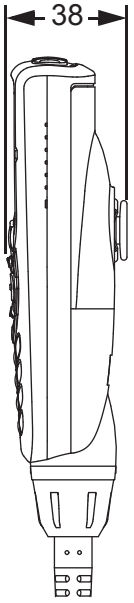


Figure 5: Front View of O5 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

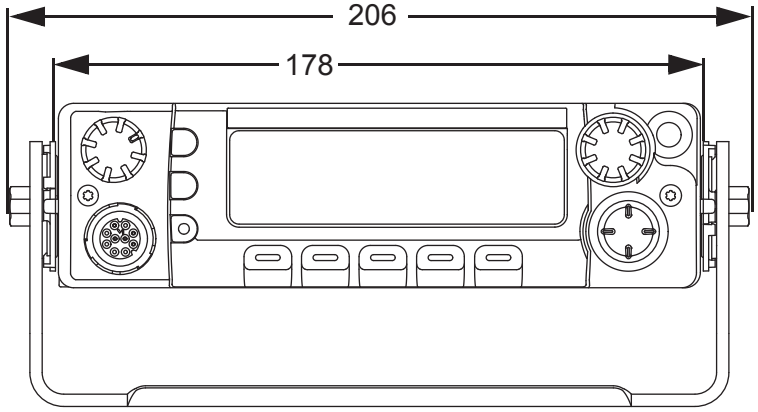


Figure 6: Side View of O5 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

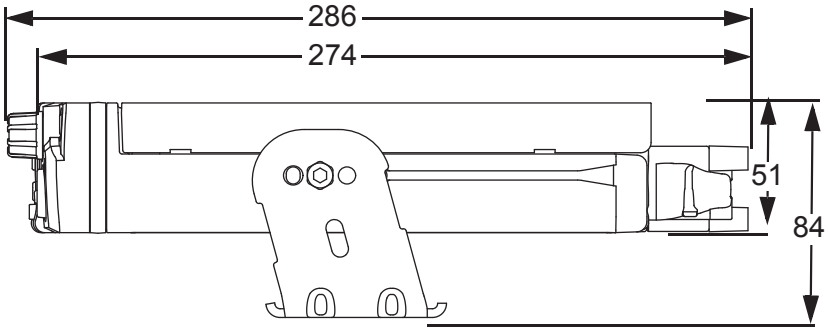


Figure 7: Front View of E5 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

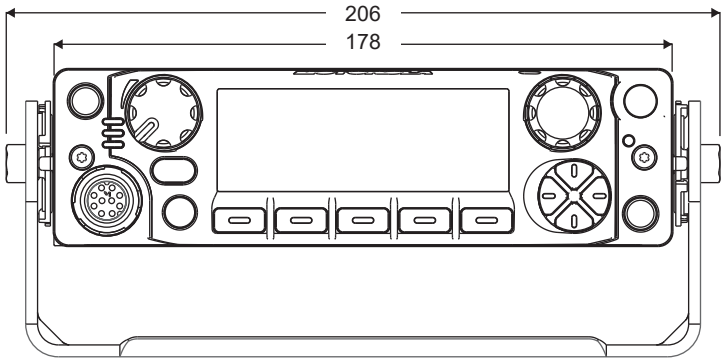


Figure 8: Side View of E5 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

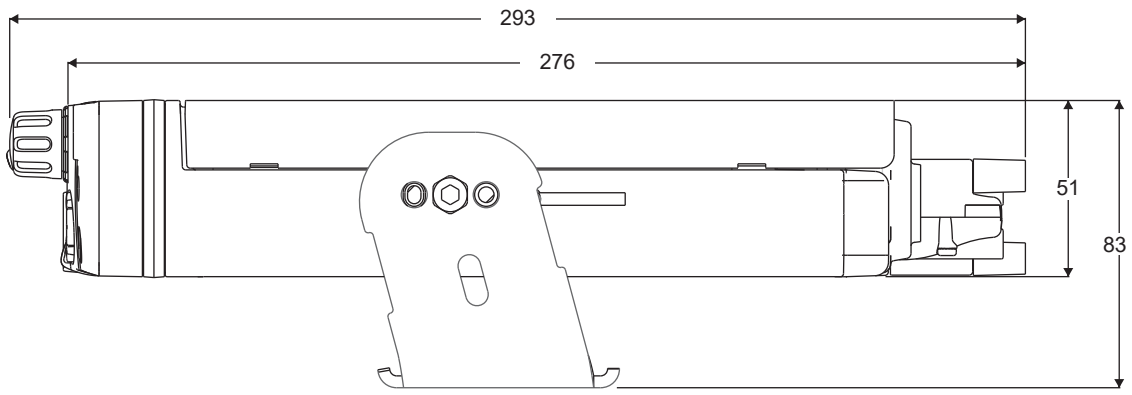


Figure 9: Front View of O7 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

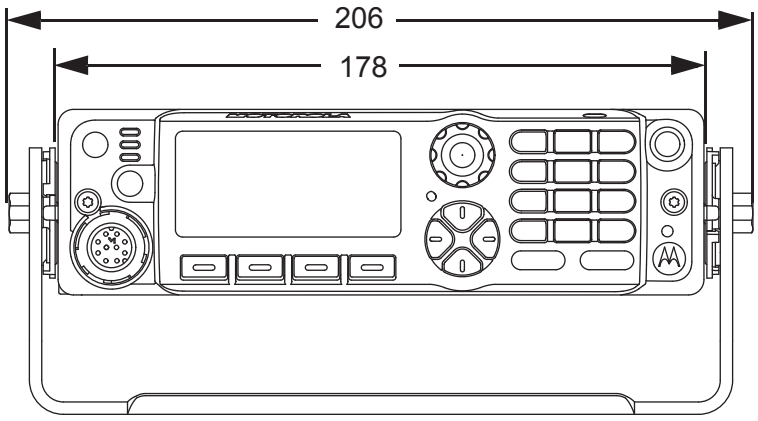


Figure 10: Side View of O7 Control Head Attached to APX 8500 Mid Power Dash Mount Transceiver and Trunnion

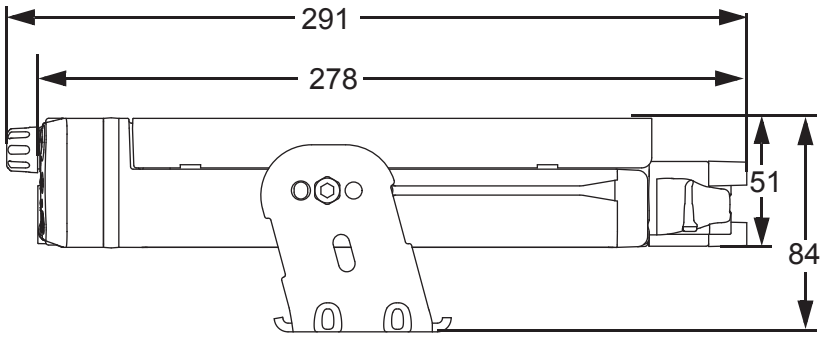


Figure 11: Front View of Mid Power Remote Mount and Trunnion on page 27 to Figure 15: Front View of High Power Remote Mount and Trunnion on page 29, show the basic dimensions of the remote mount transceiver trunnion APX mobile radio.

Figure 11: Front View of Mid Power Remote Mount and Trunnion

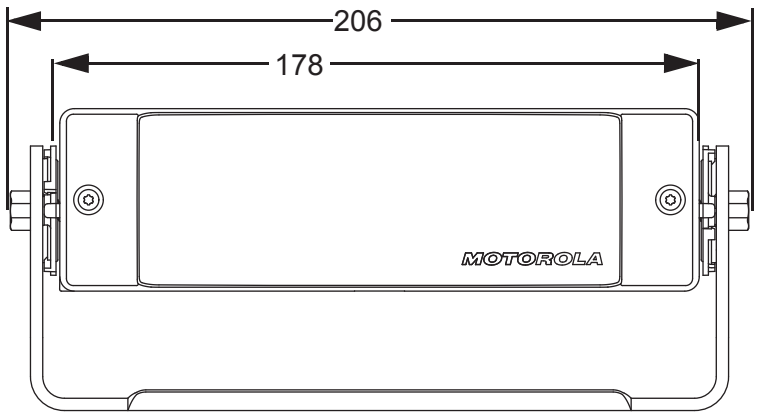


Figure 12: Side View of Mid Power Remote Mount and Trunnion

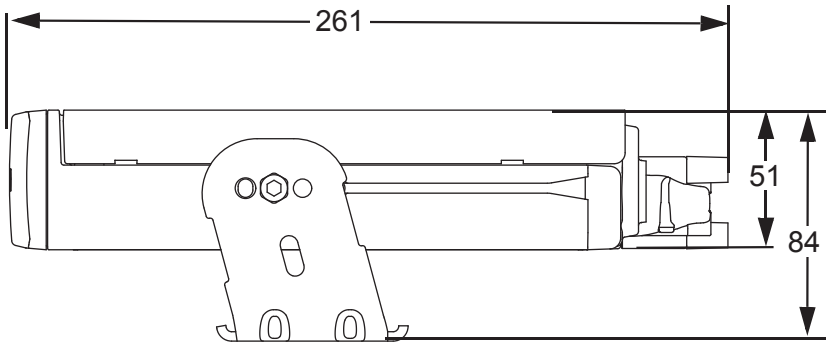


Figure 13: Front View of Mid Power Ethernet Faceplate and Trunnion

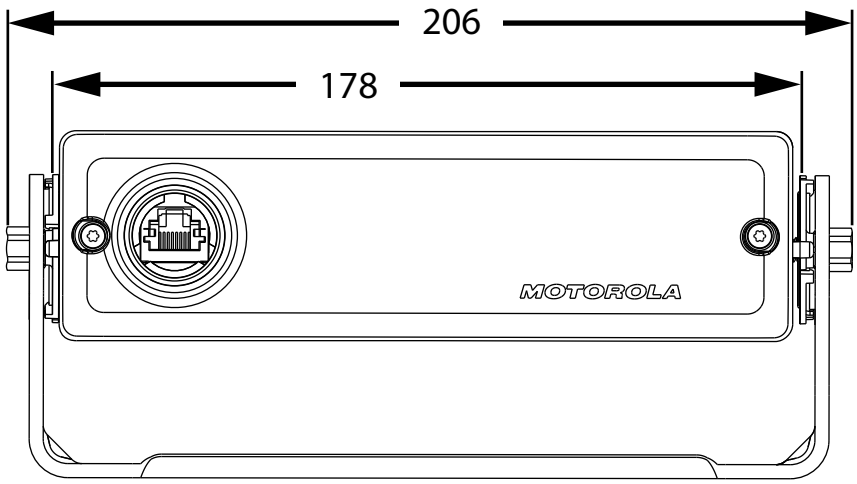


Figure 14: Side View of Mid Power Ethernet Faceplate and Trunnion

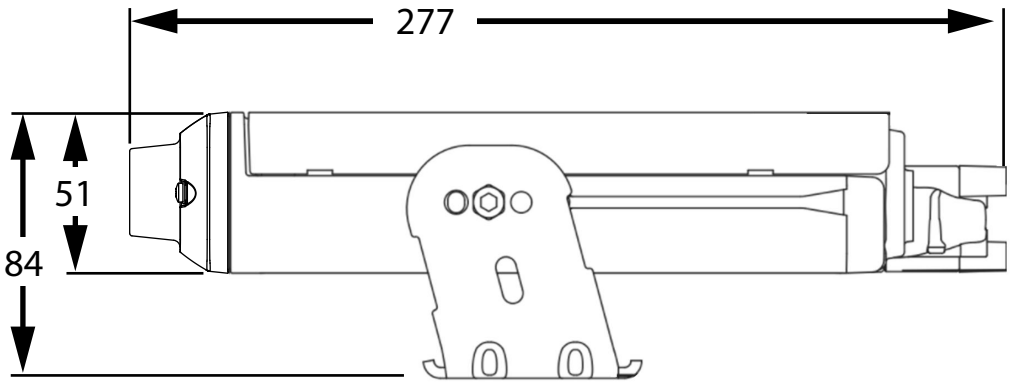


Figure 15: Front View of High Power Remote Mount and Trunnion

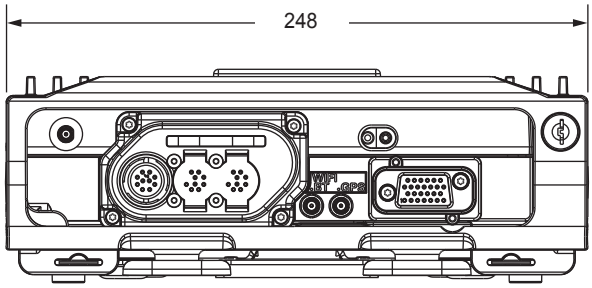


Figure 16: Side View of High Power Remote Mount and Trunnion

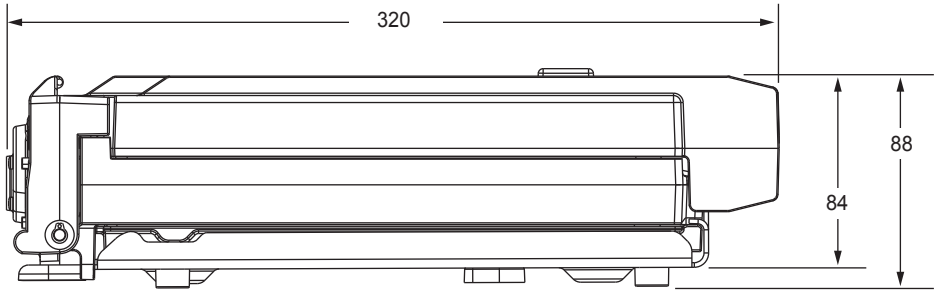


Figure 17: Front View of O2 Control Head with Remote Mount and Trunnion

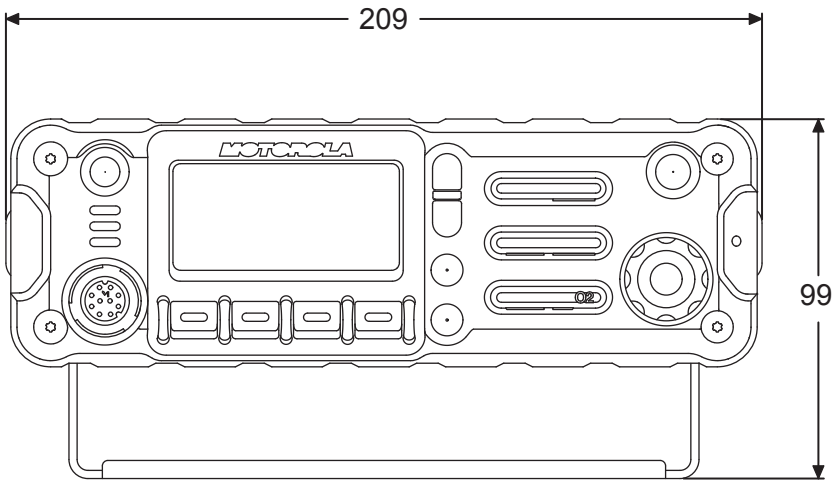


Figure 18: Side View of O2 Control Head with Remote Mount and Trunnion

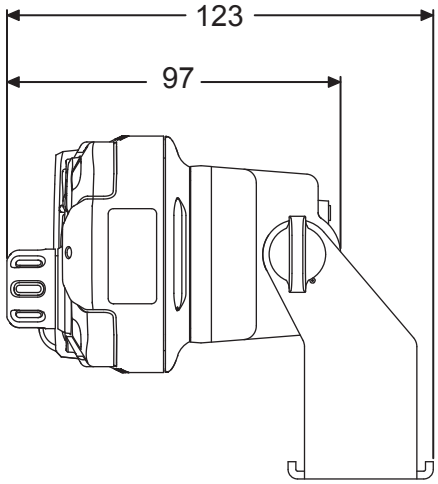


Figure 19: Front View of O5 Control Head with Remote Mount and Trunnion

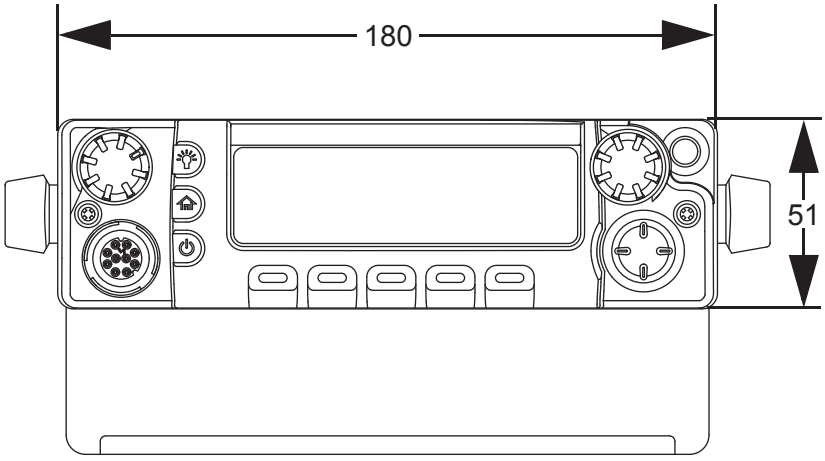


Figure 20: Side View of O5 Control Head with Remote Mount and Trunnion

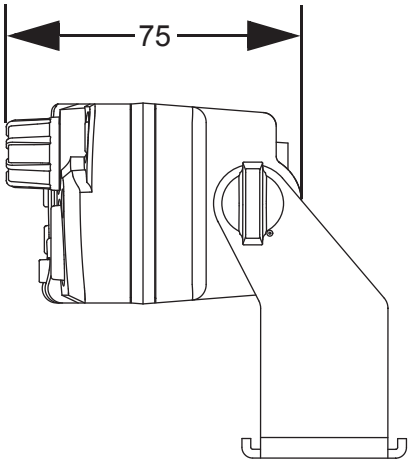


Figure 21: Front View of E5 Control Head with Remote Mount and Trunnion

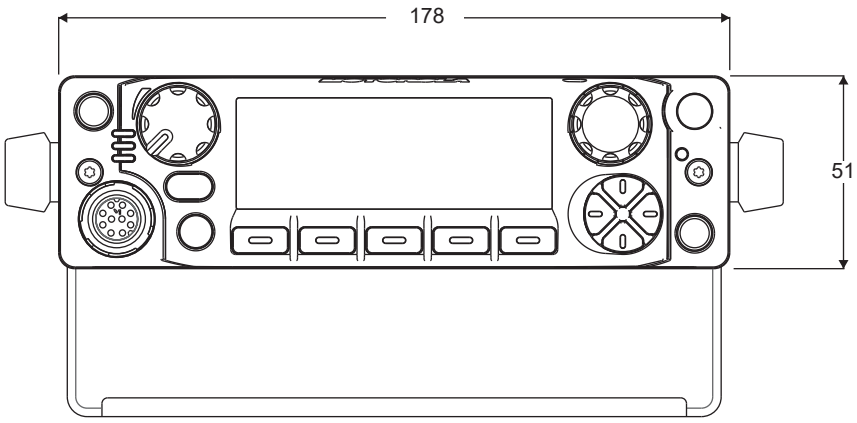


Figure 22: Side View of E5 Control Head with Remote Mount and Trunnion

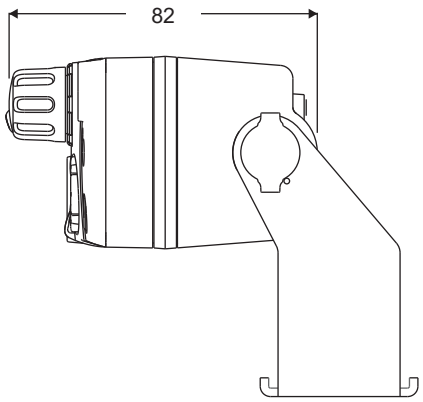


Figure 23: Front View of O7 Control Head with Remote Mount and Trunnion

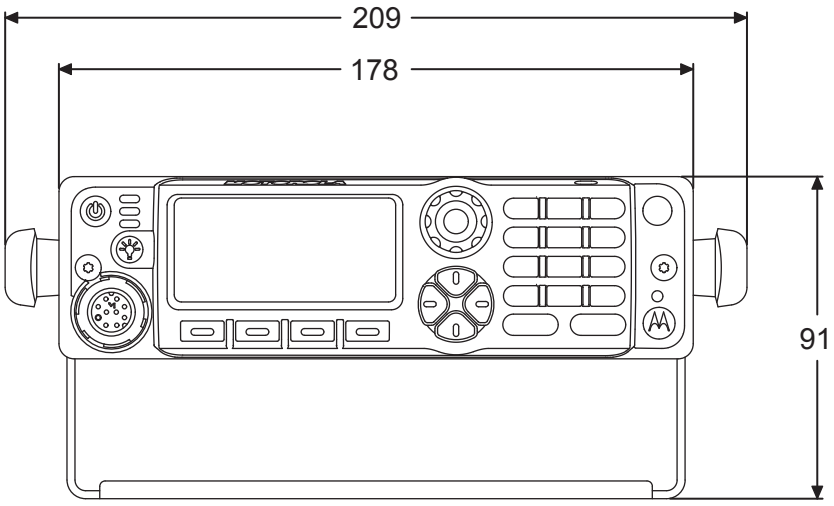


Figure 24: Side View of O7 Control Head with Remote Mount and Trunnion

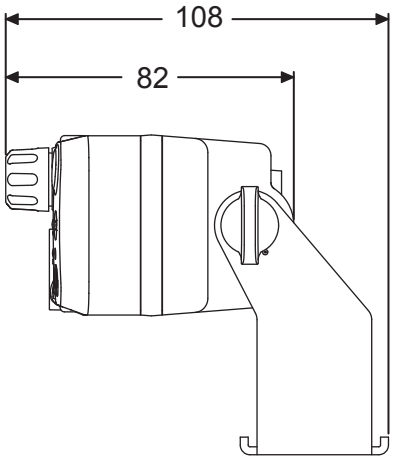


Figure 25: Front View of O9 Control Head with Trunnion

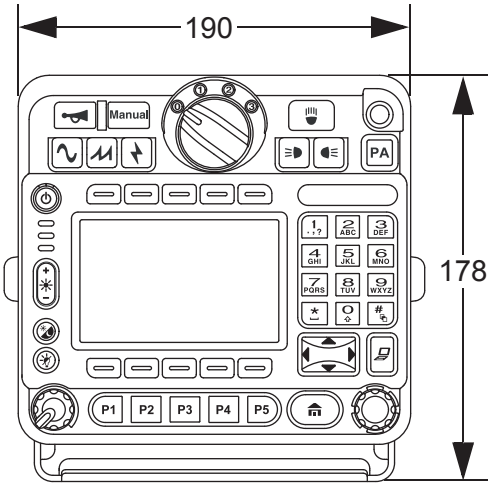


Figure 26: Side View of O9 Control Head with Trunnion

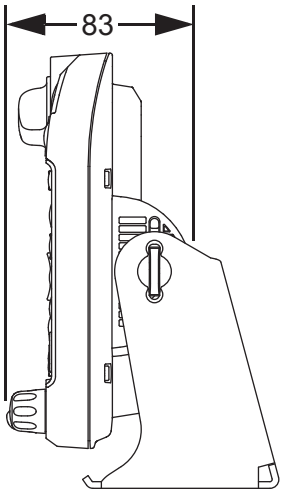


Figure 27: Top View of O9 Universal Relay Controller with Trunnion (URC is an orderable accessory)

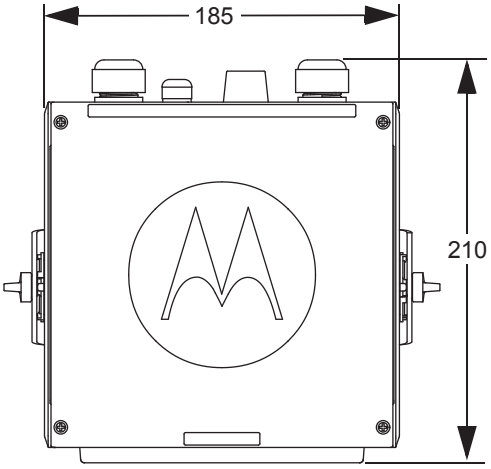


Figure 28: Side View of O9 Universal Relay Controller with Trunnion (URC is an orderable accessory)

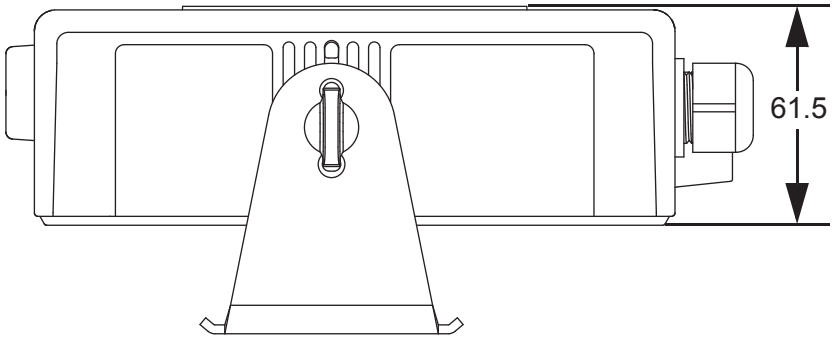


Figure 29: Siren and Lights Interface Module (SLIM)

Figure 30: Front View of SB9600 Whelen Siren

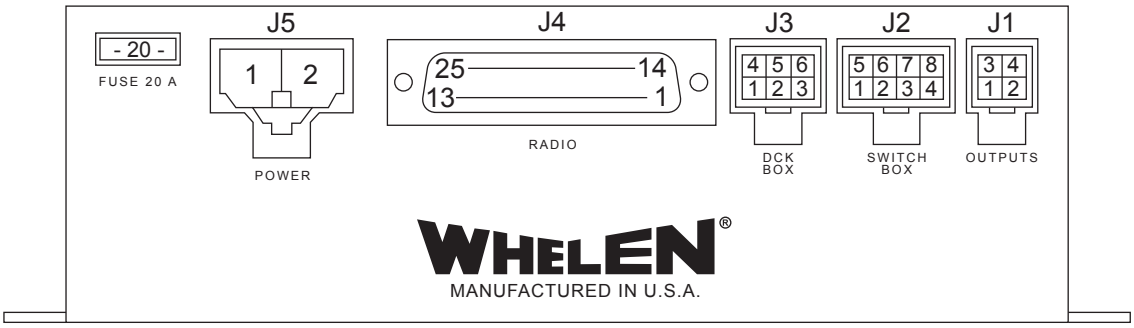
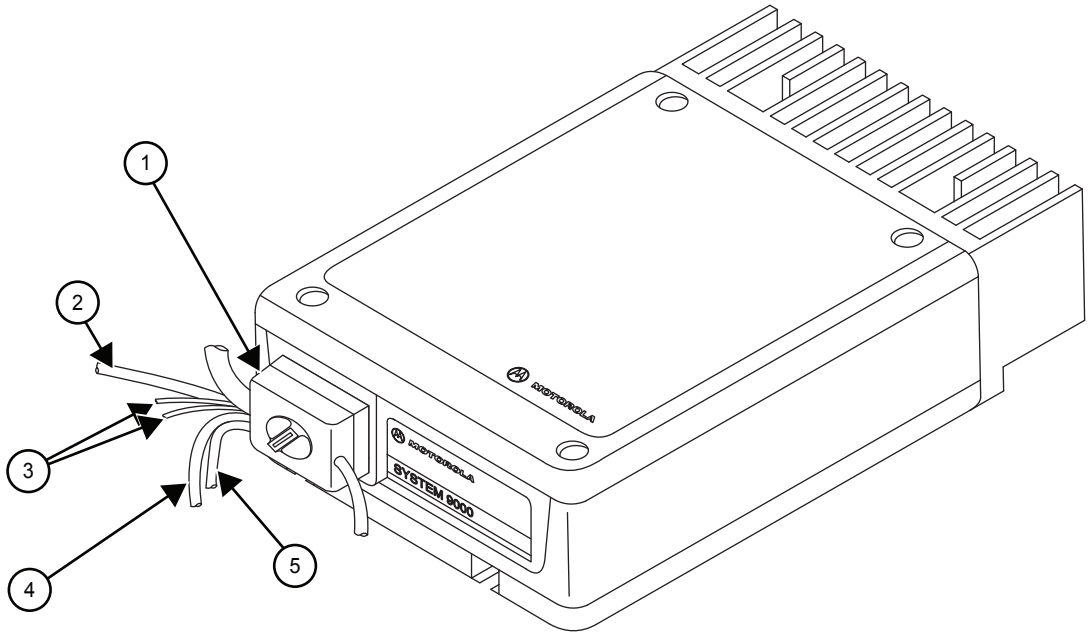


Figure 31: Siren/PA Cable Connections



1	T-Cable for Dual Control Head Only
2	To Switch Box or DEK
3	Speaker Leads
4	Black Chassis Ground Cable
5	Red Fused Cable Connects to Battery Positive Terminal

1.2
Standard Configurations

This chapter covers the dash mount configuration, remote mount configuration, and multi control head

1.2.1
Dash Mount Configuration - Mid Power Only

NOTE: The dash mount configuration is not applicable for O9 control heads.

There are two versions of the APX mobile dash mount.

- O2, O5, E5, and O7 control heads - mounted on the front of the transceiver housing
- O3 control head - connected to the transceiver through a coiled cable, which is plugged into the CAN connector on the transceiver

Figure 32: Dash Mount Configuration for O2 Control Head

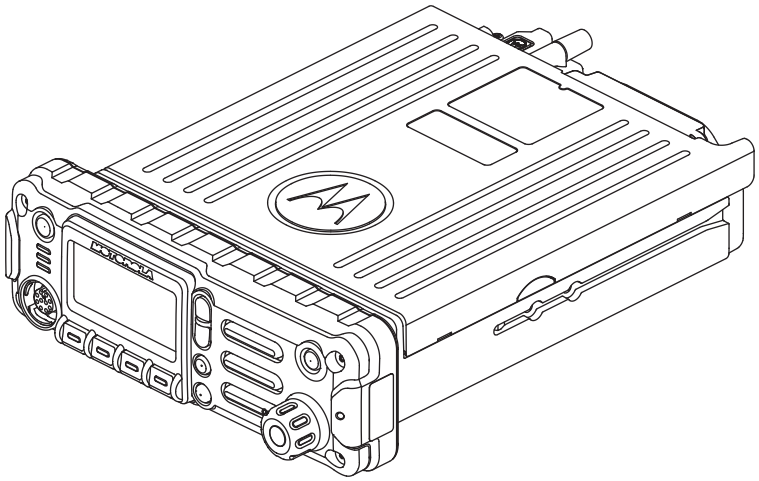


Figure 33: Dash Mount Configuration for O3 Control Head

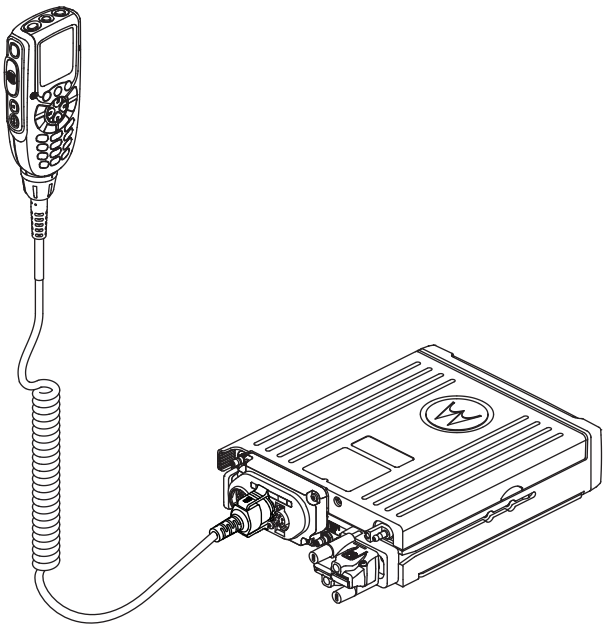


Figure 34: Dash Mount Configuration for O5 Control Head

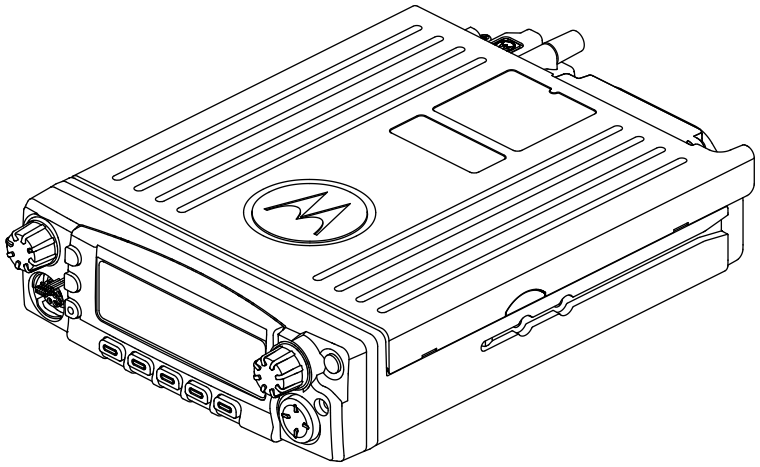


Figure 35: Dash Mount Configuration for E5 Control Head

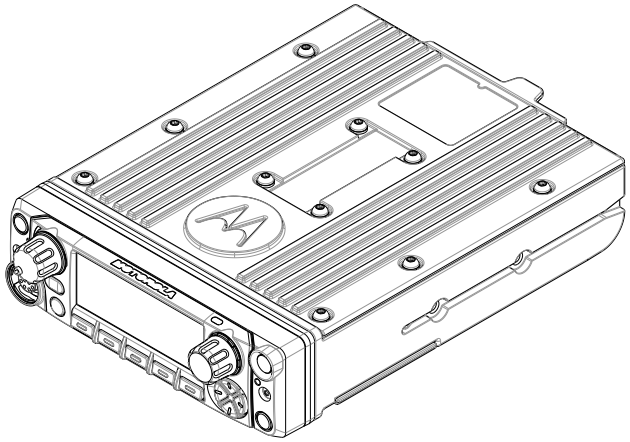
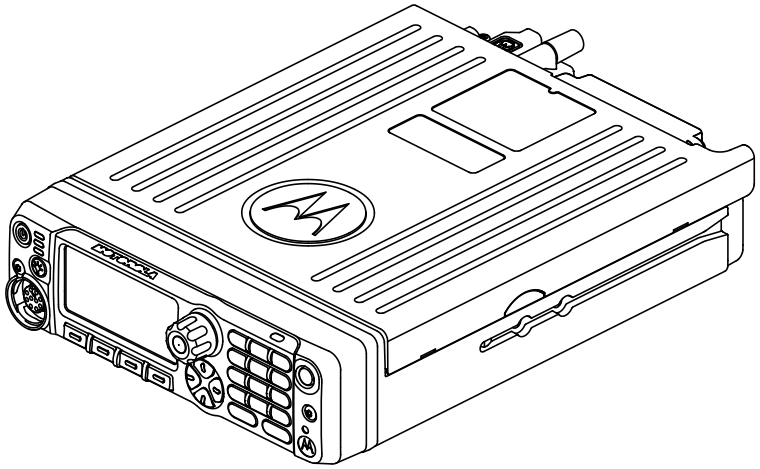


Figure 36: Dash Mount Configuration for O7 Control Head



For details on this configuration, see Dash Mount with Trunnion (Mid Power Only) on page 51.

1.2.2

Remote Mount Configuration

In the remote mount configuration, the transceiver and the control head are mounted separately in the vehicle.

The O2, O5, E5, O7, and O9 control heads are mounted in remote trunnions near the operator. The transceiver and control head are mounted using a trunnion or other mounting hardware. If the transceiver is located in a car trunk, ensure that it is mounted securely and that sufficient cooling is provided. Do not cover the transceiver with baggage, blankets, and others.

NOTE:
High power is only offered in remote mount.

The keypad mic should only be plugged into the Mobile Microphone Port (MMP) connector located on the control head, in either dash mount or remote mount configuration.

Figure 37: Remote Mount Configuration with Mid Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and O2 Control Head

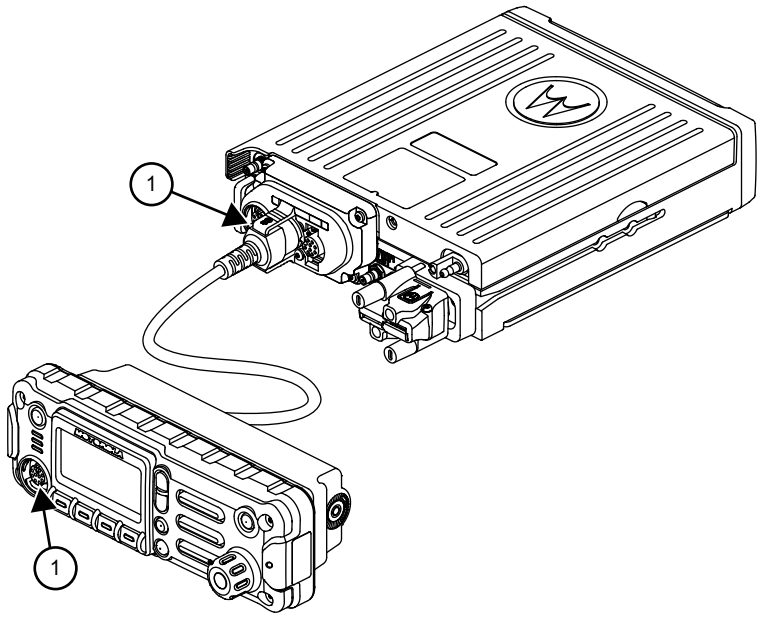


Figure 38: Remote Mount Configuration with High Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and O2 Control Head

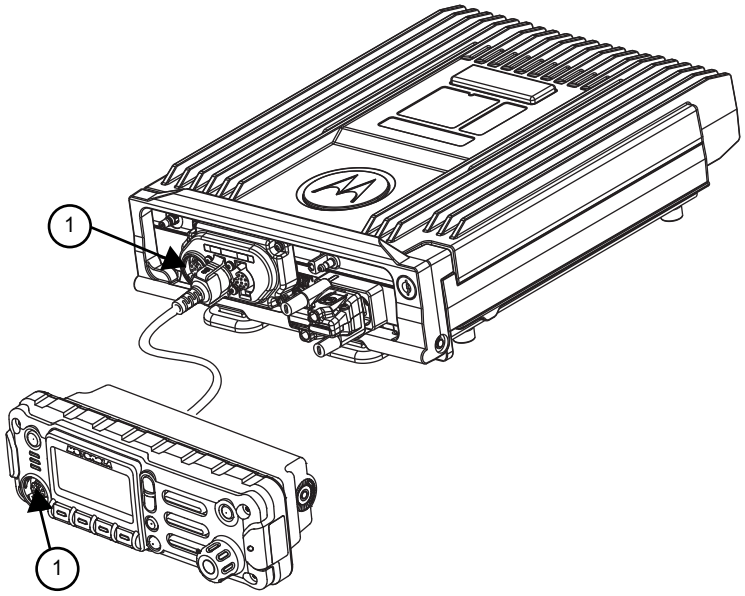


Figure 39: Remote Mount Configuration with Mid Power Transceiver, Transceiver Interface Board, and O3 Control Head

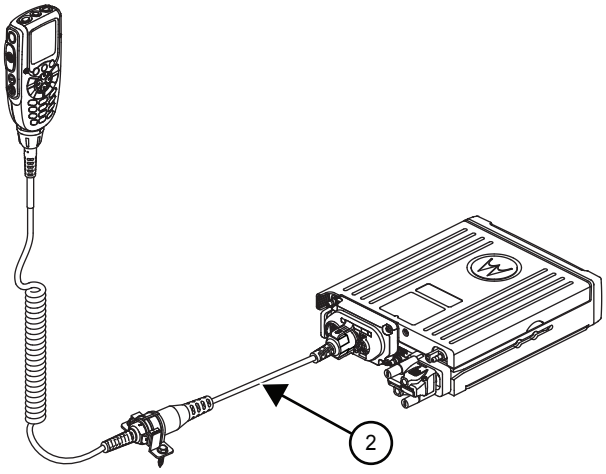


Figure 40: Remote Mount Configuration with High Power Transceiver, Transceiver Interface Board, and O3 Control Head

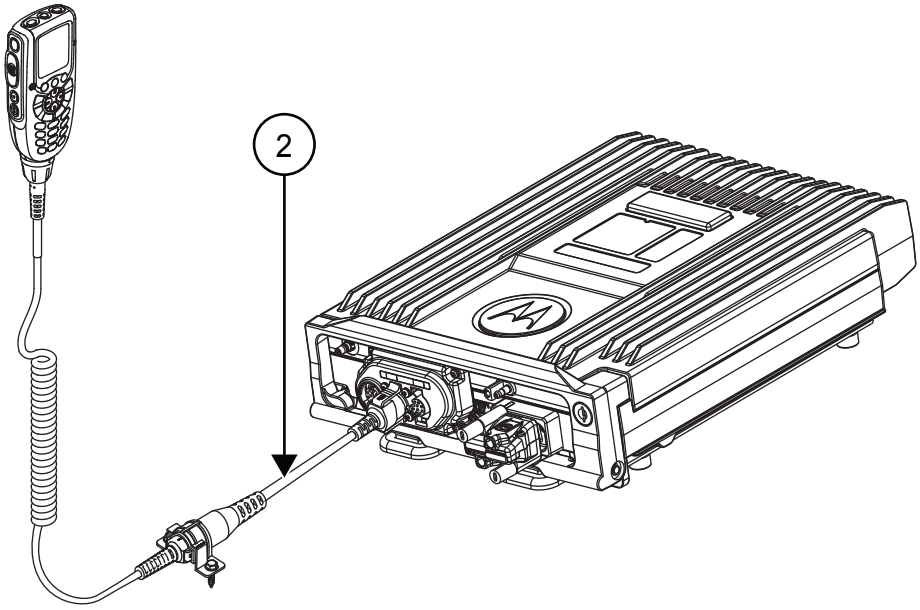


Figure 41: Remote Mount Configuration with Mid Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and O5 Control Head

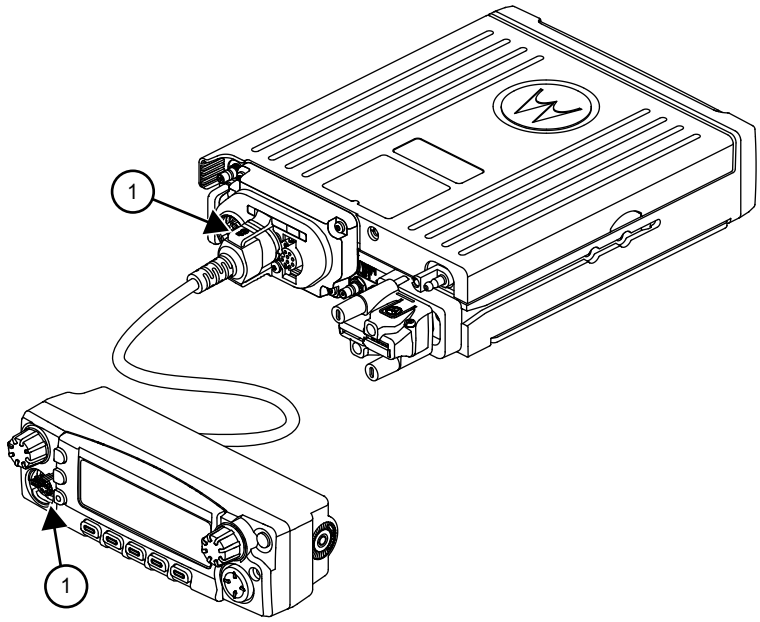


Figure 42: Remote Mount Configuration with Mid Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and E5 Control Head

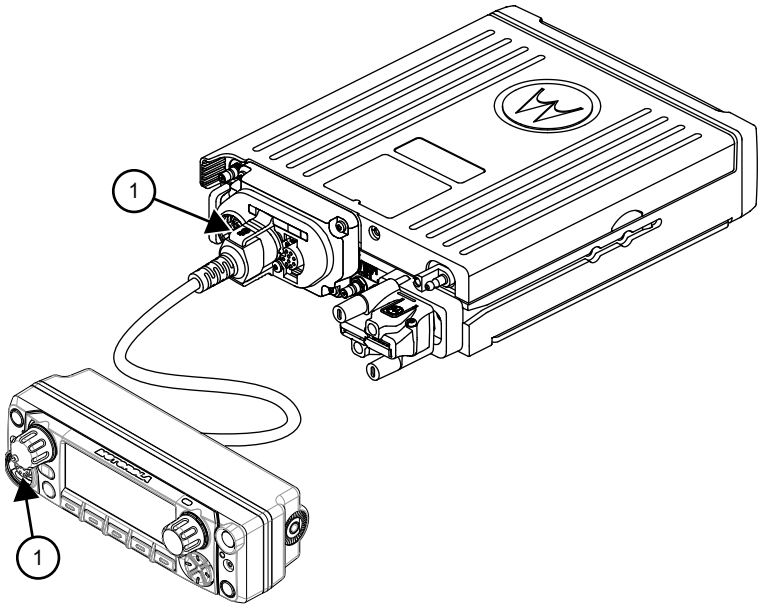


Figure 43: Remote Mount Configuration with High Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and O5 Control Head

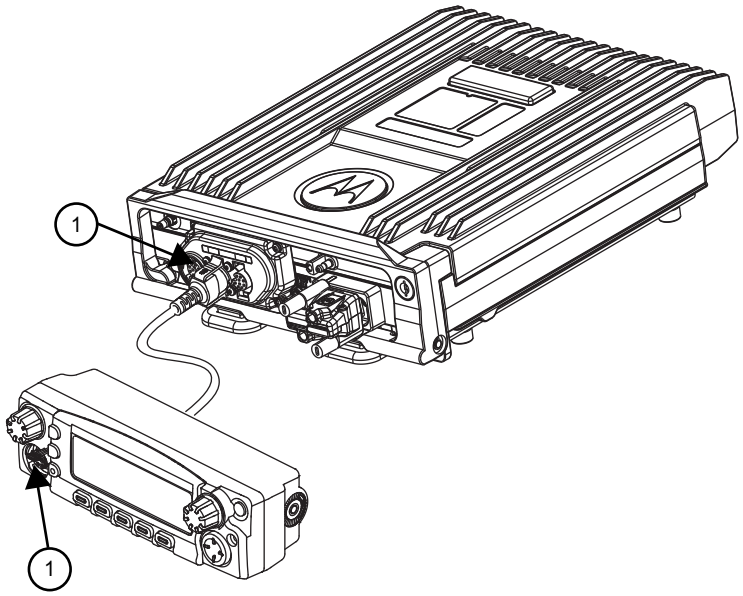


Figure 44: Remote Mount Configuration with High Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and E5 Control Head

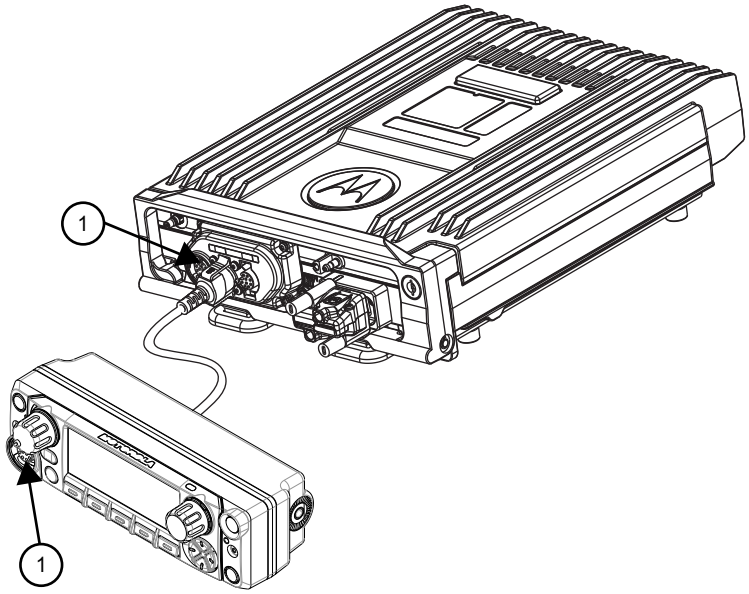


Figure 45: Remote Mount Configuration with Mid Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and O7 Control Head

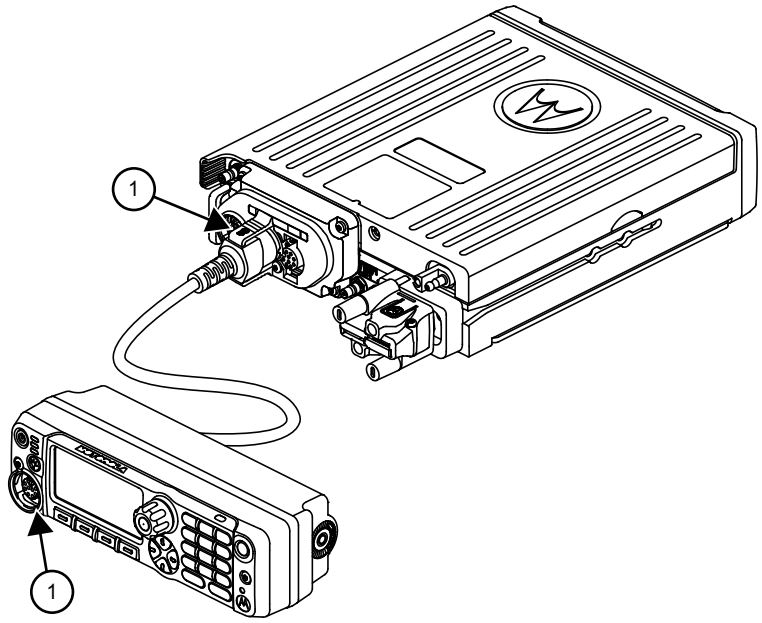


Figure 46: Remote Mount Configuration with High Power Transceiver, Transceiver Interface Board, CHIB Rear Assembly, and O7 Control Head

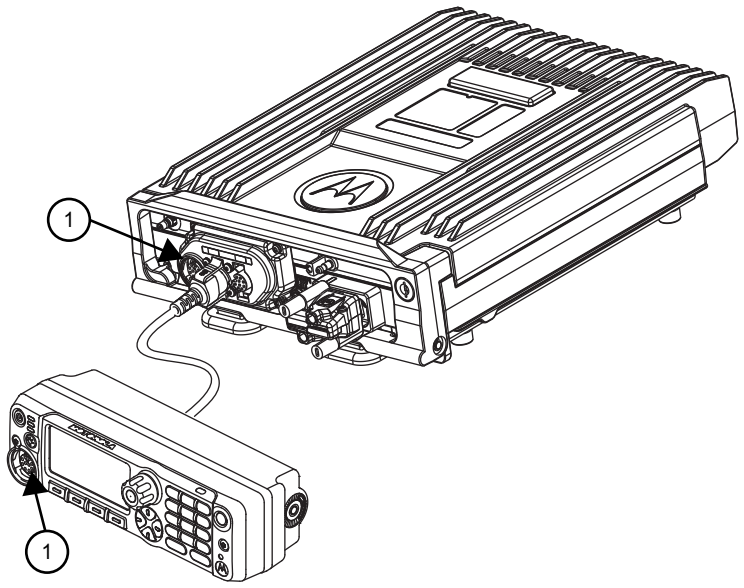


Figure 47: Remote Mount Configuration with Mid Power Transceiver, Transceiver Interface Board, and O9 Control Head

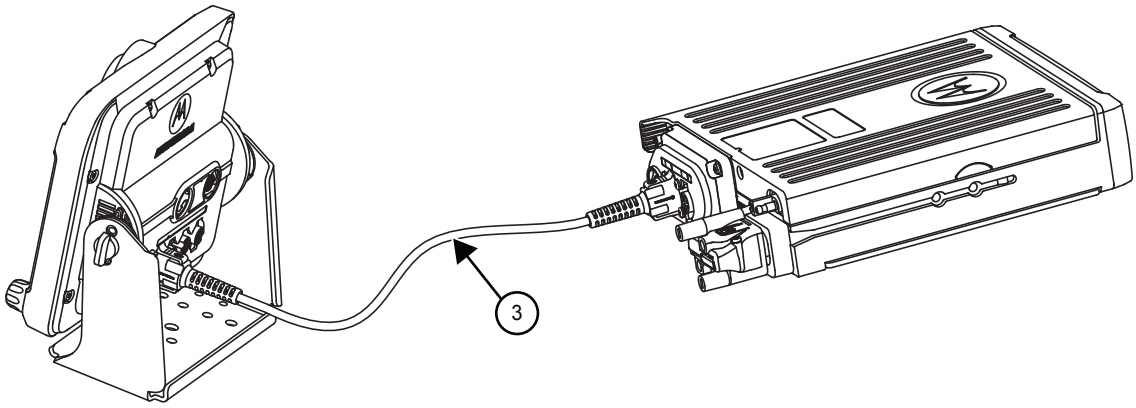


Figure 48: Remote Mount Configuration with High Power Transceiver, Transceiver Interface Board, and O9 Control Head

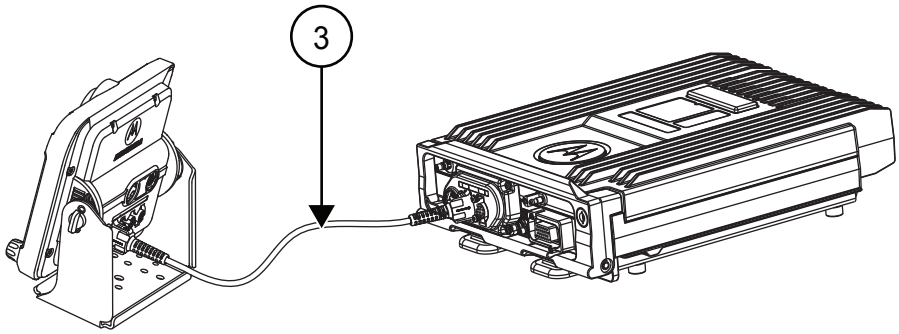


Figure 49: Remote Mount Configuration with Mid Power Radio Transceiver, Universal Relay Controller, and O7 Control Head (URC is optional) (Also Applicable for O2 and O5 Control Heads)

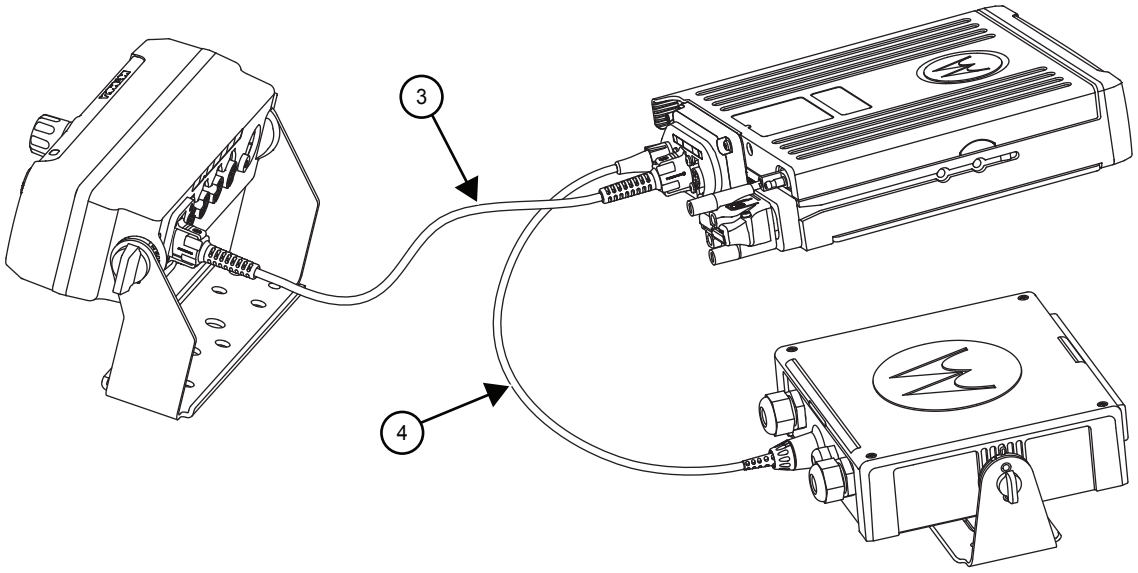


Figure 50: Remote Mount Configuration with High Power Radio Transceiver, Universal Relay Controller, and O7 Control Head (URC is optional) (Also Applicable for O2 and O5 Control Heads)

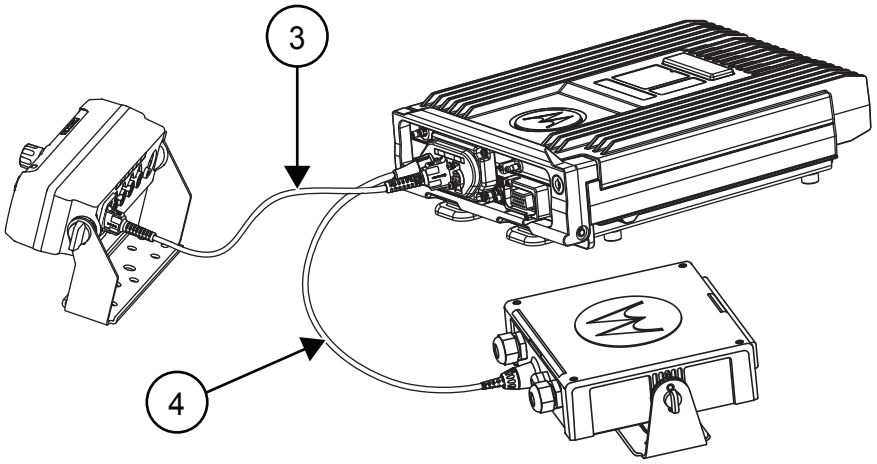


Figure 51: Remote Mount Configuration with Mid Power Radio Transceiver, Universal Relay Controller, and O9 Control Head (URC is optional)

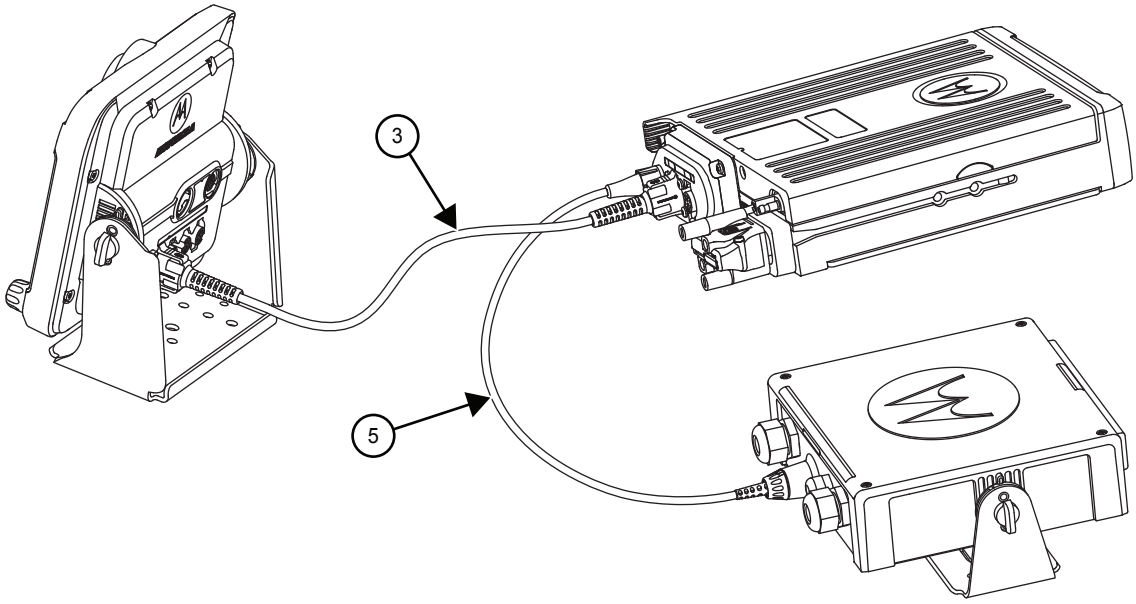
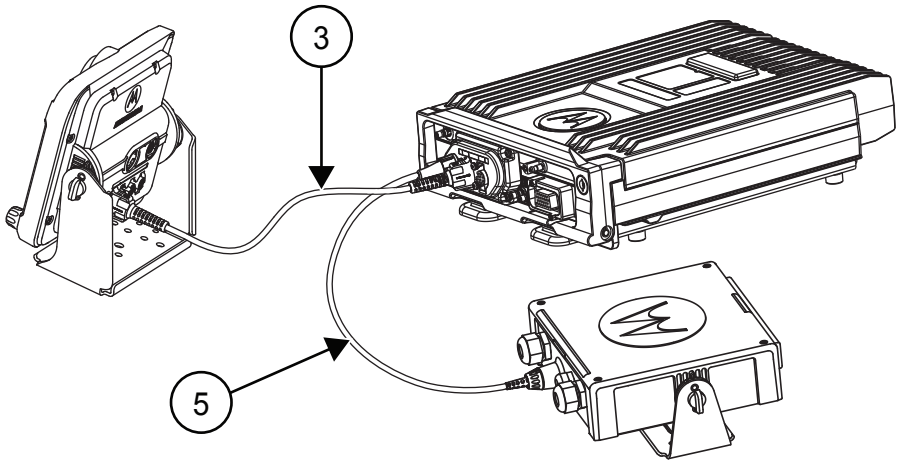


Figure 52: Remote Mount Configuration with High Power Radio Transceiver, Universal Relay Controller, and O9 Control Head (URC is optional)



1	MMP
2	5 m (17 ft) Extension Cable
3	17 ft Extension Cable
4	O7 to URC Cable
5	O9 to URC Cable

For details on these configurations, Remote Mount with Trunnion on page 52.

1.2.3
Multi Control Head

The multi control head option allows separate, remotely operated control heads to operate and control the radio.

For example, a fire truck could have a control head located in the cab and on the rear of the truck so that the radio could be operated from outside the vehicle.

1.3
Motorcycle Configurations - Mid Power Only

NOTE: The motorcycle configurations are not applicable for O9 control heads.
See Motorcycle Radio Installation (Mid Power) on page 107 for further information.

1.4
Base/Control Stations

NOTE: The base/control station option is not applicable for O9 control heads and high power radios.

If mobile radio equipment is installed at a fixed location and operates as a control station or as a fixed unit, the antenna installation must comply with the following requirements in order to ensure optimal performance and compliance with the RF energy exposure limits in the standards and guidelines listed in the Safety Manual (refer to Related Publications on page 16).

- The antenna should be mounted outside the building on the roof or a tower if at all possible.
- As with all fixed site antenna installations, it is the responsibility of the licensee to manage the site in accordance with applicable regulatory requirements and may require additional compliance actions such as site survey measurements, signage, and site access restrictions in order to ensure that exposure limits are not exceeded.

1.5
Tools Required for APX Mobile Installations

Tool	Part Number
10 mm wrench	–
5 mm Allen wrench	–
Regular slot screwdriver of Phillips #2	–
Pin removal tool	6680163F01

Chapter 2

Standard Configurations

The radio operates only in negative ground electrical systems with a valid operating range of 13.6 V +/- 20%. Before starting the installation, ensure that the ground polarity of the vehicle is correct. Accidentally reversing the polarity could damage the radio and cause the cable fuses to blow.

2.1 Planning the Installation

Planning is the key to fast, easy radio installation. Before starting the installation, inspect the vehicle and determine how and where you intend to mount the antenna, radio, and accessories. Plan wire and cable run to provide maximum protection from pinching, crushing, and overheating.

CAUTION:
Before installing any electrical equipment, check the user manual of the vehicle for warnings or recommendations.

Authorized servicer or installer should complete the installation of this device. Failure to properly install the device may result in damage to the device, or improper operation.

2.1.1 Radio Operation Wiring for Dash and Remote Configurations

Determine the radio functionality you wish to achieve from the tables in Remote Mount: Power, Ignition, and Emergency Cable Installation on page 47, which is the vehicle ignition switch state is controlling, the physical wiring of the radio ignition sense (ACC) wire, and by the programmed CPS setting. For more radio functionality as determined by the programming of the ignition switch in the CPS, refer to the **Help** menu in your CPS (Ignition as: Required, Blank, Soft Power Off, TX Inhibit, PTT TX Inhibit, Ignition Only Power Up).

Choose a clean ignition point which is not shared in the immediate vicinity by other high current accessories/devices. This choice helps to reduce the transients on the ignition line. Examples of high-current accessories/devices are air horn, relays, and lightbars. It is safe to wire to the vehicle ACC line, not the START, or the solenoid side of the ignition circuit. Refer to Finishing the Installation on page 139 for best installation practices. The Ignition sense (ACC) cable uses either a 3 A fuse (6580283E01) or 4 A fuse (6580283E02).

2.1.1.1 Dash Mount: Power, Ignition, and Emergency Cable Installation (Mid Power Only)

The standard dash mount rear ignition sense cable HLN6863 contains a “thin red” ignition wire, a jumper wire that shorts emergency to ground, and two gray wires attached to an external speaker plug. The thin RED wire is the ignition sense wire. Refer to the tables from Remote Mount: Power, Ignition, and Emergency Cable Installation on page 47 for its correct wiring configurations.

NOTE: This cable must be attached for the radio to operate in dash mount configuration regardless of how emergency is programmed in the CPS or wired inside the vehicle. Either the emergency jumper wire or an emergency accessory (footswitch or button) must be wired to the rear of the radio in dash mount configuration. Otherwise, upon attachment of the radio power cable to the vehicle battery, the radio incorrectly determines that emergency operation has been activated, such as when an emergency footswitch is de-pressed and the emergency pin is ungrounded.

2.1.1.2

Remote Mount: Power, Ignition, and Emergency Cable Installation

The single control head O2, O3, O5, E5, O7, and O9 remote mount configurations receive power from the J200 red and black wires connector. The yellow wire at J200 is an ignition sense wire. The J2 connector can also be used for ignition sense.

If HLN6863 is attached at J100 of the O2, O3, O5, E5, O7, or O9 control head, the “thin red” wire do not function as an ignition sense wire, since the J100 connector has no ignition sense electrical connection.

NOTE: It is incorrect to attach the ignition sense wire to more than one wire or connector.
Refer to the following tables for its correct wiring configurations.

The O3 control head receives its power down the CAN cable, and detects the ignition state by the ignition sense pin at J2. The J2 connector can be used for ignition sense.

In Multi-Control Head installations, the yellow ignition wire must be connected to the head assigned ID #1. See Setting the Initial Control Head ID on page 61 for further information.

The design of the control head is different compared to the radio. Therefore it is also not necessary to attach HLN6863 to J100 to prevent accidental emergency operation. The control head can have an emergency accessory attached to connector J100 instead of to the radio connector J2. Wherever the emergency accessory is placed, it is recommended to only attach to one location rather than multiple emergency accessories attached to different points of the radio.

Table 2: Dash and Remote O2, O3, O5, E5, O7, or O9 Radio Power ON at J2

Dash Mount	Transceiver Red Power Wire	HLN6863 Thin Red Wire	Transceiver Red Power Wire	HLN6863 Thin Red Wire	Transceiver Red Power Wire	HLN6863 Thin Red Wire
Connected to battery	X	X	X			X
Connected to ignition switch				X	X	X
Ignition switch controls	No ignition switch control.		Enables ignition switch functionality as programmed in the codeplug.		Illegal wiring configuration.	

Table 3: Remote O2, O5, O7, or O9 Radio Power ON @ J200

Remote Mount	Control Head Red Wire	Control Head Yellow Wire	Control Head Red Wire	Control Head Yellow Wire	Control Head Red Wire	Control Head Yellow Wire
Connected to battery	X	X	X			X
Connected to ignition switch				X	X	X
Ignition switch controls	No ignition switch control.		Enables ignition switch functionality as programmed in the codeplug.		Illegal wiring configuration.	

Table 4: Ignition Interface Cables

Part Number	Description
HLN6863_	Cable, M.A.P. 26 pin with Only Ignition and SPK
KT000274A01	Y-Cable, M.A.P to M.A.P. and DB 25

CAUTION:
DO NOT connect any wires to the battery terminals until you have finished the entire radio installation (dash or remote mount configuration) to avoid potential equipment damage.

Incorrect wiring of the radio may result in incorrect ignition sense detection, incorrect power-on state, or incorrect power-off state of the radio system.

The Control Head Power cable wire (RED) and Transceiver Power cable wire (RED) are always attached to the battery terminal and NOT to the ignition switch.

2.1.2
Ignition Sense Switch (Radio Wide Advance)

The CPS (Customer Programming Software) selectable settings is used to control the radio functionality based on the state of the vehicle Ignition status. These descriptions can be found in the CPS tool HELP Guides and are repeated here for convenience.

Table 5: Ignition Sense Switch Settings in CPS

Feature	Description
Blank	• Radio POWERS ON when the **Power** button is pressed or with the Emergency Power-up feature. • Radio POWERS OFF when the **Power** button is pressed.

TX Inhibit	(Available only when the radio is model/option capable)
	• Radio POWERS ON with a radio **Power On** button/knob selection.
	• Radio POWERS OFF with a radio **Power Off** button/knob selection, or when the Inactivity Auto Power-off timer expires.
	• While IGNITION is not present, the following communications are not possible:
	  ○ The radio does not register with ASTRO 25 (APCO) - Trunking Systems and therefore cannot receive this type of trunking communications (see the System Type field), however, Type II Trunking Systems can receive dispatch without being registered.
	  ○ The radio cannot be powered-on with the Emergency Power-up feature and Emergency Alarm transmissions using the Emergency Power-up footswitch are not possible.

PTT TX Inhibit	(Available only when the radio is model/option capable) • Radio POWERS ON with a radio **Power On** button/knob selection. • Radio POWERS OFF with a radio **Power Off** button/knob selection, or when the Inactivity Auto Power-off timer expires. • While IGNITION is not present, all **PTT** button transmissions are inhibited:

Feature	Description
	○ The radio does not register with ASTRO 25 (APCO) - Trunking Systems and therefore cannot receive this type of trunking communications (see the System Type field), however, Type II Trunking Systems can receive dispatch without being registered. ○ The radio cannot be powered-on with the an Emergency Power-up foot-switch-press, however, the footswitch can be used to initiate Emergency Alarm transmissions if the radio is already turned on.
Required	• Radio POWERS ON when the **Power** button is pressed and Ignition is present. • Radio POWERS ON when Ignition is cycled and radio was previously turned ON. • Radio POWERS OFF when the **Power** button is pressed, or when Ignition is lost.
Soft Power-off	• Radio POWERS ON when the **Power** button is pressed, or when Ignition is detected. • Radio POWERS OFF when the **Power** button is pressed, or when Ignition is lost.
Ignition Only Power-up	• Radio POWERS ON when Ignition is present. • Radio POWERS OFF when Ignition is lost. • Control head **Power** button is ignored.

NOTE: When either TX Inhibit, PTT TX Inhibit or Required are selected, the Emergency Power-up feature is not available.

When any other Ignition Switch setting is made, Emergency Power-up is available regardless of the current ignition state.

Any optional inactivity time-out timer setting in CPS may delay the power-off of the radio once Ignition sense is removed.

2.1.3
Motorola Solutions Branded SB9600 Siren/PA Configuration and Programming

The Siren/PA is shipped pre-wired for 100 W operation. It can be rewired for 65 W, 75 W, or 130 W power levels. Refer to this procedure if you want to change to another power level.

Procedure:

1. Open the Siren/PA connector cover to gain access to the two-connector speaker leads.

   Do not change the speaker common lead (pin 20). The other lead is connected to pin 35 (for 100 W operation).
2. Using an appropriate pin removal tool, extract pin 35 and move it to one of the following pin locations:
   - Pin location 36 for 75 W operation
   - Pin location 28 for 65 W or 130 W operation
3. Do one of the following:

- For 65 W or 75 W operation, reassemble the connector.
- For 130 W operation, parallel the two 11 Ω speakers, each rated at 65 W minimum.

Proper phasing of the two speakers is important when connecting two speakers in parallel, wire similar speaker terminals together to ensure maximum loudness and prevent "deadspots". For example, if the terminals are marked "1" and "2", connect the terminals marked "1" together and connect those wires to one speaker lead. Connect the terminals marked "2" together and connect those wires to the other speaker lead.

CAUTION: Before continuing, remember that under a high-line supply condition (16.6 V), up to 30% more power goes to the speakers after reconfiguring for 130 W operation. Do this setting only when your PA speakers can handle the extra power.

4. When the Siren/PA is configured for dual speaker for 130 W operation, it is necessary to remove a resistor and move two jumpers to set the correct power level. Remove the Siren/PA cover, and locate resistor R219 (0 Ω). This resistor should be removed for 130 W operation. Locate jumpers JU100 and JU101. These jumpers should be installed for 130 W operation.
5. Close and reconnect the Siren/PA connector cover.

NOTE: Jumpers JU100 and JU101 do not affect the Siren output level. JU100 and JU101 compensate for the lower speaker load and the two speakers in parallel by decreasing the gain U102-1. JU100 affects the radio PA level and JU101 affects the PA audio level.

Pin locations of various power level configurations are listed in the following table.

Table 6: Power Level Configurations

Power Level	Pin Location of Speaker Leads	R219	JU100/JU101
65 W	20, 28	IN	Across pins A and B
75 W	20, 36	IN	Across pins A and B
100 W	20, 35	IN	Across pins A and B
130 W	20, 28	OUT	Across pins B and C

2.2 Radio Mounting

CAUTION:
The radio must be mounted to a frame equivalent location in the vehicle when using the Impact Detection feature.

DO NOT mount the radio on a plastic mounting surface without first reinforcing the mounting surface; the weight of the radio may crack or break the mounting surface.

DO NOT mount the radio on a flat or concave surface where the radio could be partially submersed in water. It is especially important if the cab area of the vehicle is cleaned by spraying it with water. If the radio sits in water for a length of time, moisture may seep inside the radio and damage the electronic components.

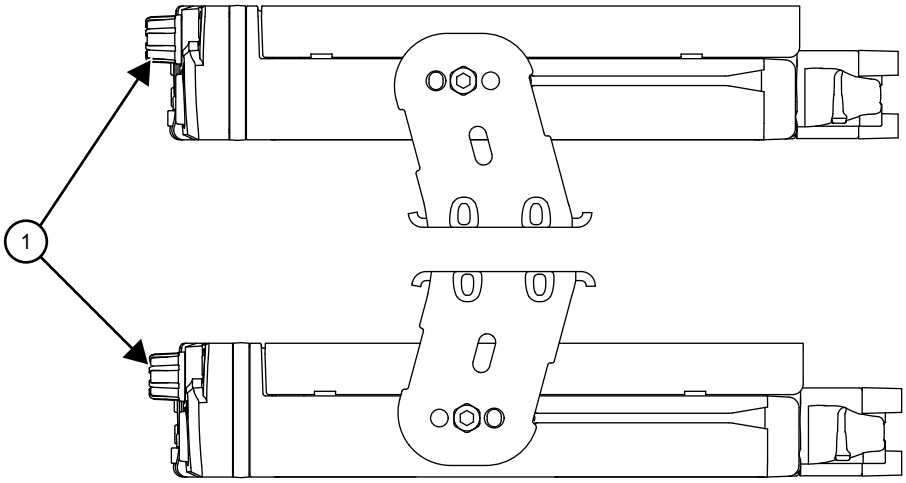
DO NOT allow water to stand in recessed areas of vertically mounted radios. Remove any moisture immediately to prevent it from seeping down into the radio.

Shield the control head (front and back) from direct exposure to pressurized water. The pressurized water from a hose usually is more severe than the stated test and conditions in typical environments.

The mounting location must be accessible and visible. Select a location that permits routing the RF antenna cable as directly as possible.

NOTE: For optimum radio performance, orient the mounting trunnion as shown in the following figures. For new or existing installations, use only the APX mobile trunnion, kit number HLN7002 (mid power) and HLN7003 (high power).

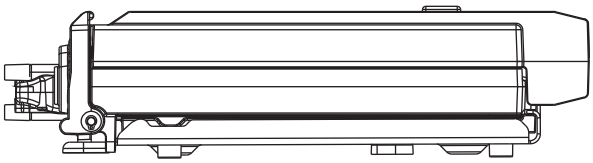
Figure 53: APX 8500 Mid Power Trunnion Orientation



Applies to radios in dash and remote installations.

No.	Description
1	Radio Front

Figure 54: APX 8500 High Power Trunnion Orientation



Applies to radios in remote installations.

2.2.1 Dash Mount with Trunnion (Mid Power Only)

Procedure:

1. Mount your radio on the transmission hump or under the dash.

   NOTE:
   When mounting the trunnion on the transmission hump, ensure that the transmission housing is not affected. Plan your installation, ensuring enough room for the accessory connector and cable at the back of the radio.

Figure 55: Below Dash Trunnion Mounting

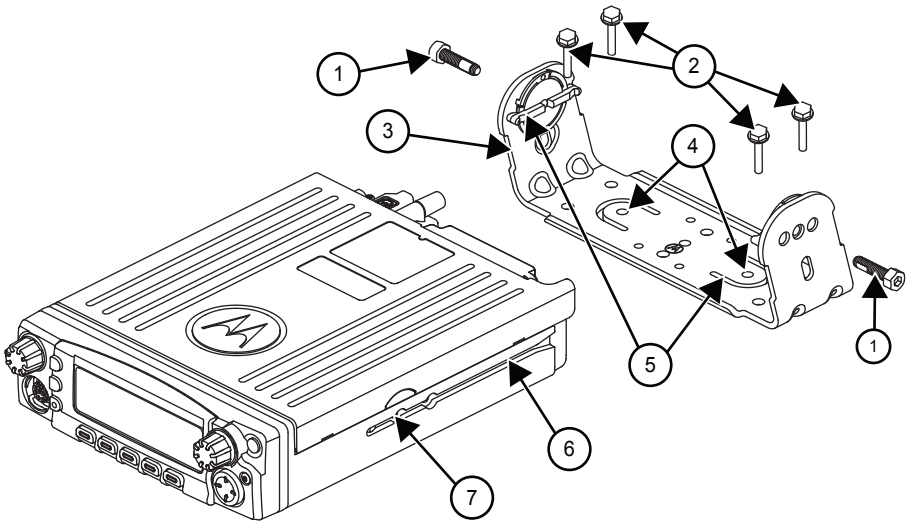


Table 7: Mid Power Trunnion Kit

Item	Part Number	Description
1	0371859H01	Trunnion Mounting Screw
2	0312002B14	Self-Drilling Tapping Screw
3	HLN7002_	Mackinaw Trunnion Hardware Kit
4	-	Tab
5	-	Plastic Guides
6	-	Groove
7	-	Threaded Hole for Screw

2. Using the trunnion mounting bracket as a template, mark the positions of the holes on the mounting surface. Use the innermost four holes for a curved mounting surface such as the transmission hump, and the four outermost holes for a flat surface such as under the dash.
3. Center punch the spots you have marked and realign the trunnion in position.
4. Secure the trunnion mounting bracket with the four self-drilling screws provided.
5. Ensure that the plastic guides are aligned (horizontal) to the grooves of the trunnion. Slide the radio into the grooves until it snaps into place.
6. Secure the radio with the two screws provided (Item 1). The torque down force for 0371859H01 should be between 50 in-lbf to 52 in-lbf.

NOTE: This configuration shows the O5 control head. The TIB is used for O3 control head for the same configuration.

2.2.2 Remote Mount with Trunnion

For remote mount installation, the radio may be mounted anywhere in the vehicle, as long as the installation location is safe, follows the cautions mentioned at the beginning of this section, and is accessible for servicing/maintenance and cabling. A typical mounting location recommended by Motorola Solutions is in

the trunk of the vehicle. For mid power, the trunnion provided is used to mount the transceiver, and the mounting process is the same for dash mount installation.

2.2.2.1

Installing Remote Mount for High Power

The followings are the remote installation procedure for high power.

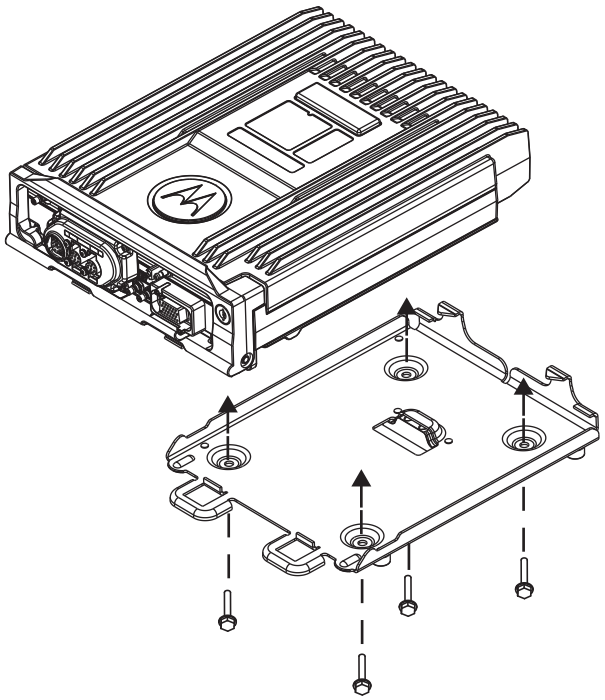
When and where to use:

NOTE: Cabling to the front of the radio (TIB) should not be completed with the handle opened, as the handle will not close with cables attached. It is suggested that the cabling be attached to the front of the radio after the radio is assembled into the trunnion.

Procedure:

1. After selecting the mounting location, use the trunnion mounting bracket as a template and mark the positions of the holes on the mounting surface
2. Center-punch the spots you have marked and realign the trunnion in position.
3. Secure the trunnion mounting bracket with the four self-drilling screws provided. See Figure 56: High Power Radio Mounting into Quick Release Trunnion on page 53.
4. After the trunnion has been mounted in the vehicle using the screws provided, install the radio. Place the radio with the lock handle fully opened on the trunnion, oriented at least 10 mm in front of the rear catches. Push the radio towards the rear catches. The radio is lifted up slightly and then drops back down, flushed with the trunnion, and stops against the rear catches. Once this occurs, close the lock handle by rotating the handle towards the top of the radio until it is locked in place. The key is not needed in the lock to close the handle, but is needed to reopen. The keys can only be removed from the lock when it is in the locked position.

Figure 56: High Power Radio Mounting into Quick Release Trunnion



2.2.2.2

Remote Mount Control Head Installation

Choose a mounting location for the radio, considering accessibility, and control and antenna cable lengths.

The recommended mounting surfaces for the control unit are under the mounting surface, on the transmission hump, or on the center console. Installing Remote Mount Control Head on page 54 shows how you should install the trunnion, control head, and cables for the O2, O3, O5, E5, O7, or O9 control head.

NOTE:
Connector-protective covers (Remote Mount Dust Covers kit) KT000246A01 are provided with the radio. Install the covers on exposed connectors for added environmental robustness.

An adjustable trunnion, which allows several mounting positions, is supplied to mount the control unit. The installation must not interfere with the operation of the vehicle or its accessories, nor disturb passenger seating or leg room. The control head must be within convenient reach and viewing of the user.

If the trunnion is mounted on a plastic mounting surface, all four mounting screws should penetrate the supporting metal frame of the mounting surface. If that is not possible, use a metal backing plate (not supplied) to strengthen the installation.

2.2.2.2.1

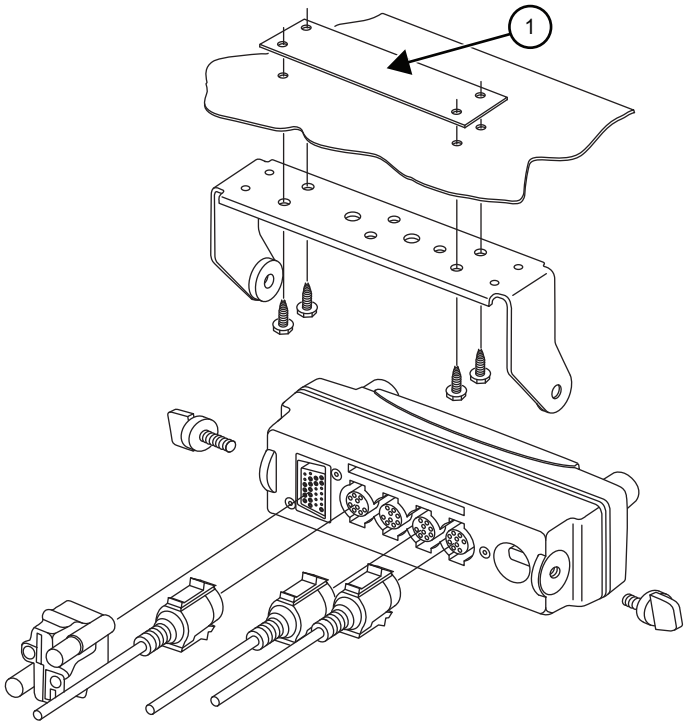
Installing Remote Mount Control Head

Procedure:

1. Use the control unit trunnion as a template to mark the mounting holes; drill 5/32" holes.
   If mounting on a plastic surface, use a metal backing plate.
2. Attach the trunnion bracket using all four 10-16" x 5/8" self-tapping screws provided.
3. Temporarily install the control head (adjusting for proper viewing angle) and fasten it to the trunnion with two wing screws.
4. Test the installation to ensure that the control head feels securely locked in place while you are pressing its buttons.
5. Finish the installation by fully tightening the screws.

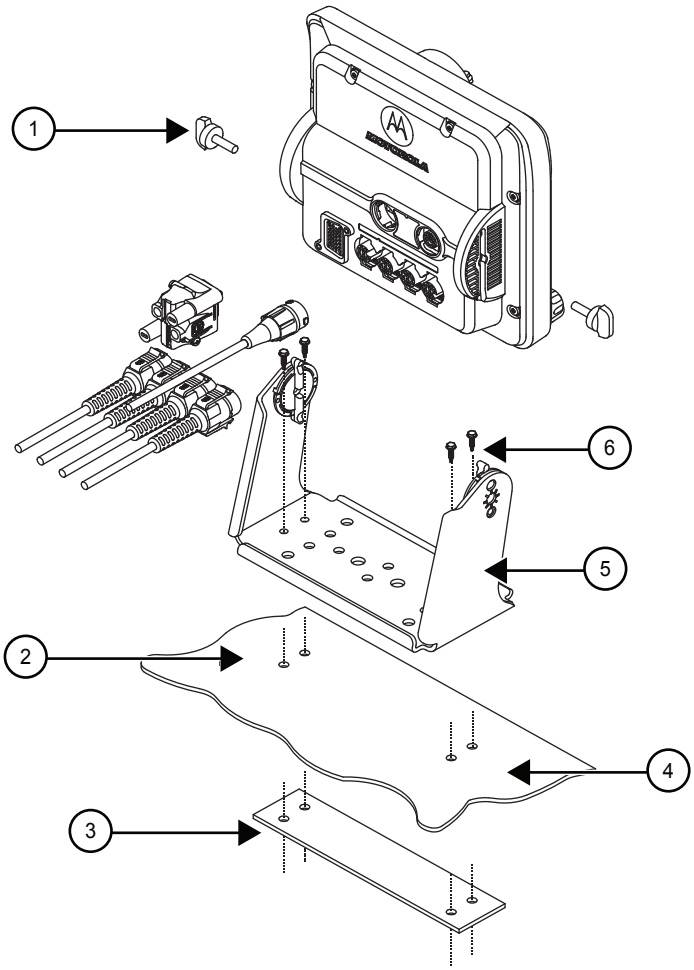
Result:

Figure 57: O5 Control Head Installation Exploded View (Also applicable for O2, O7 and E5 Control Heads)



No.	Description
1	Metal Backing Plate (Not Supplied)

Figure 58: O9 Control Head Installation Exploded View



No.	Description
1	Adjust the control head to a desired angle and secure with wing screws
2	Mounting surface
3	**IMPORTANT:** If the trunnion is mounted on a plastic or unstable surface, use a metal backing plate (not supplied).
4	Drill four 5/32” holes in the mounting surface
5	Trunnion
6	Use four mounting screws on all installations

Figure 59: O5 Control Head Rear View (Also applicable for O2 and O7 Control Heads)

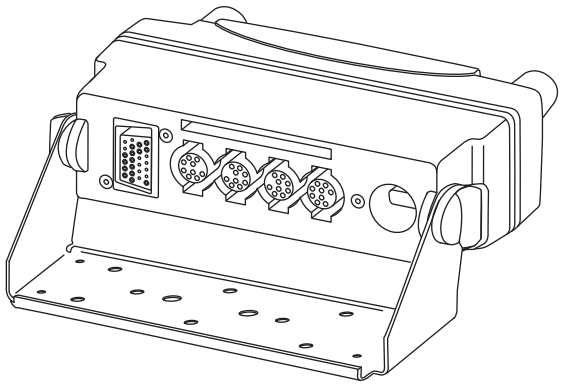


Figure 60: E5 Control Head Rear View

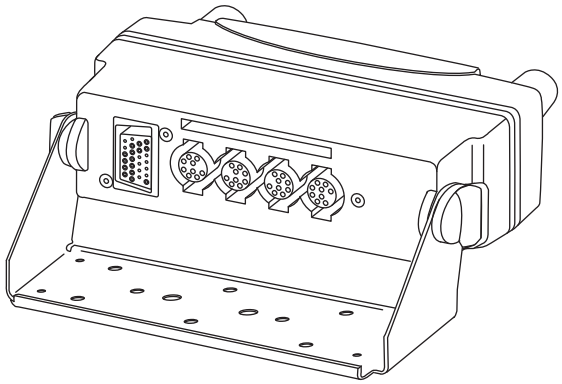
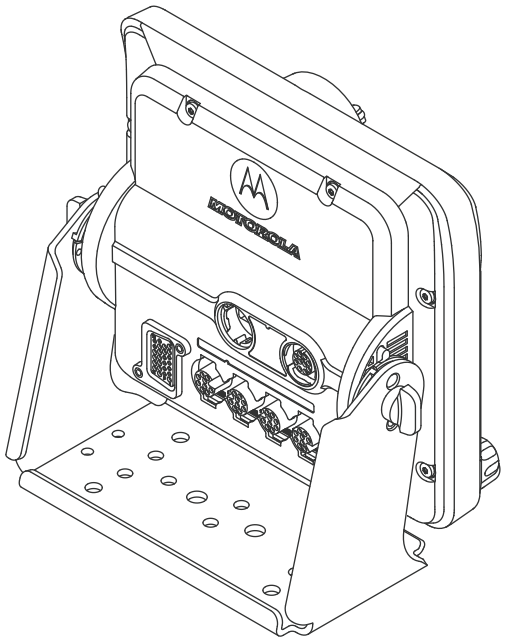


Figure 61: O9 Control Head Rear View



2.2.2.3

Multiple Control Head Installation

Install control heads in a multiple control head configuration as per the steps detailed in Installing Remote Mount Control Head on page 54. Two heads can be connected to each of the two CAN connectors on the radio. You can also connect control heads in a “daisy chain” configuration from the CAN connector of a single radio. See the following figures for examples.

NOTE: The transceiver must be configured for Multiple Control Head through CPS programming. Navigate to the **Control Head** tab in the **Radio Wide** section of the CPS, and select **Help** for further information and tutorials.

Figure 62: Multiple Control Heads Parallel Configurations (Mid Power)

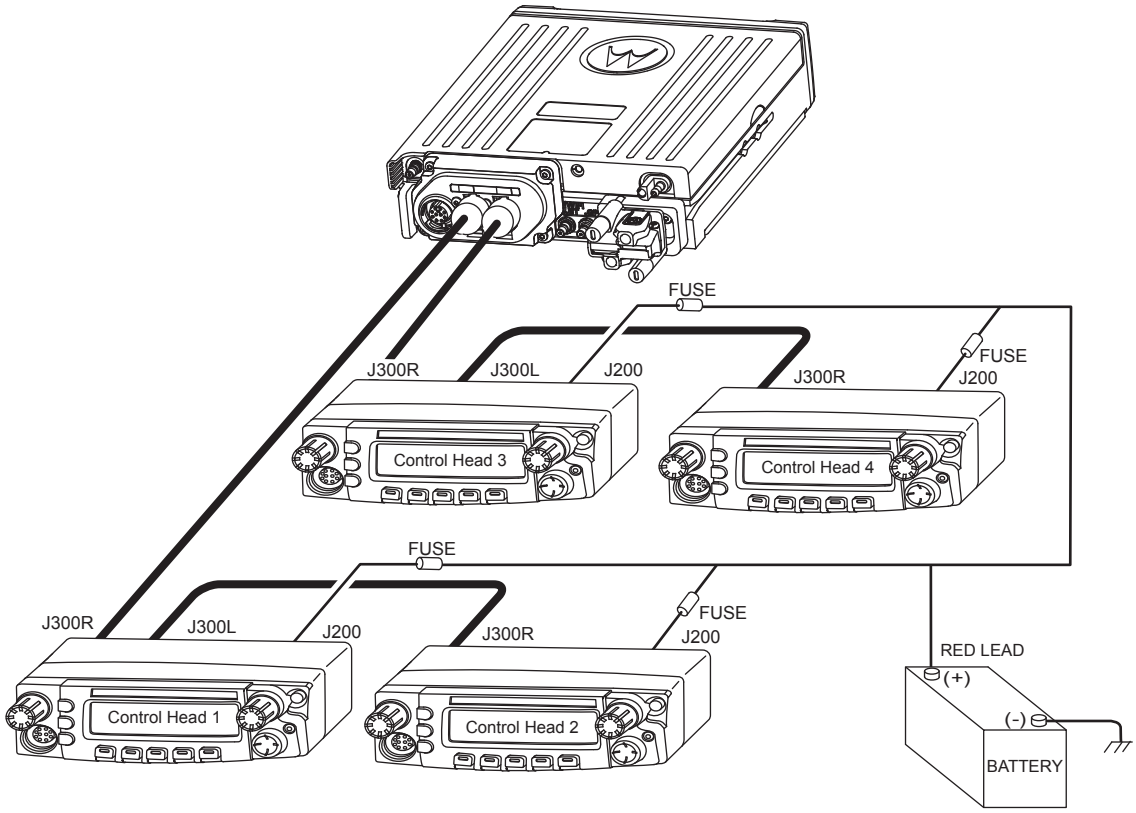


Figure 63: Multiple Control Heads Parallel Configurations (High Power)

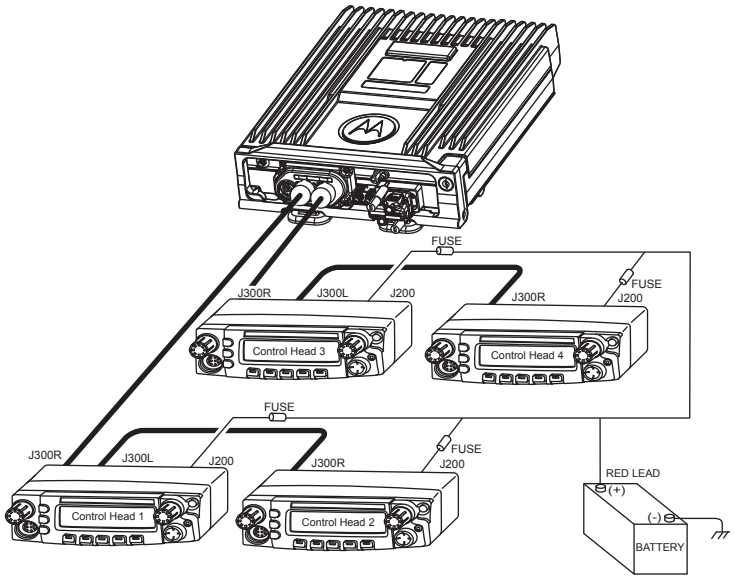


Figure 64: Multiple Control Heads Series Configurations (Mid Power)

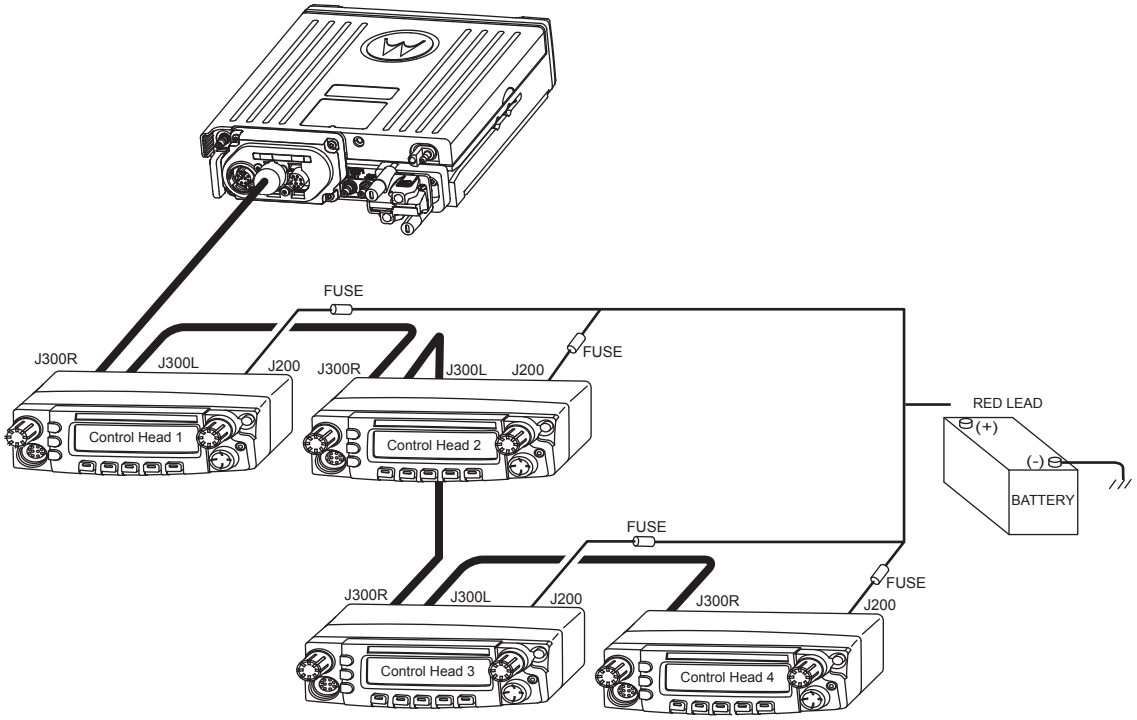
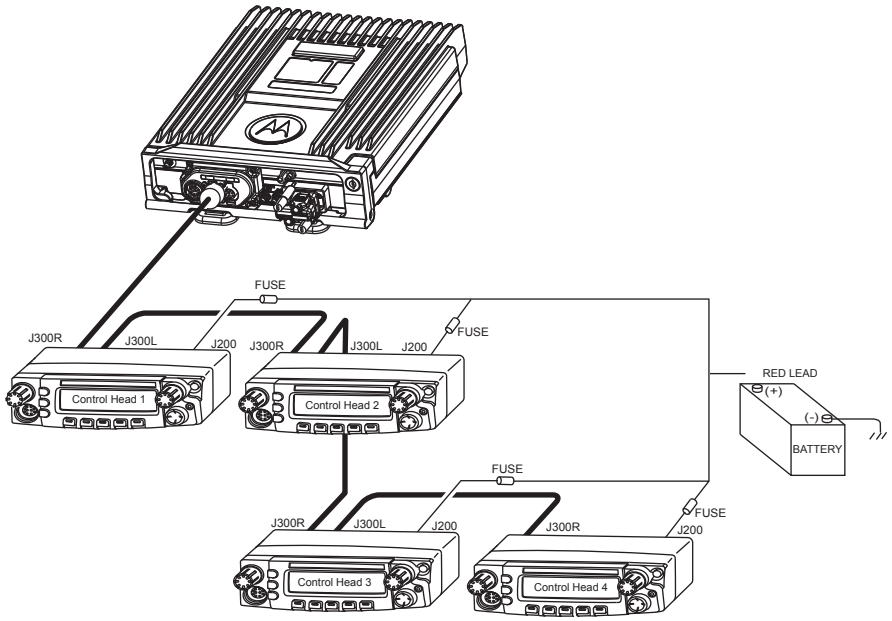


Figure 65: Multiple Control Heads Series Configurations (High Power)



NOTE: In Multiple Control Head (MCH) installations, the yellow ignition sense wire must be connected to the head assigned ID # 1. See Setting the Initial Control Head ID on page 61 for further information.

Use the most convenient configuration for your installation, ensuring that the combined cable lengths do not exceed 131 feet (40 meters). See Table 8: Available CAN Cables on page 60 for a list of available CAN cable lengths. Control head ground, power and ignition sense wires (black, red, and yellow respectively) may need more length (not supplied) in installations that locate the head more than 10 feet from a power source.

Table 8: Available CAN Cables

Part Number	Description
HKN6164_	Cable, Remote Mount, 40 m (131 ft)
HKN6165_	Cable, Remote Mount, 35 m (115 ft)
HKN6166_	Cable, Remote Mount, 23 m (75 ft)
HKN6167_	Cable, Remote Mount, 15 m (50 ft)
HKN6168_	Cable, Remote Mount, 9 m (30 ft)
HKN6169_	Cable, Remote Mount, 5 m (17 ft)
HKN6170_	Cable, Remote Mount, 3 m (10 ft)
PMLN4958_	Cable, O3 Extension, 5 m (17 ft)

2.2.2.4
Cable Installation

Route the cables where they are protected from pinching, sharp edges or crushing. Use grommets in any holes where the cable passes through metal panels.

Figure 17 shows how the cables and components are connected. It is not recommended to route cabling or wiring inside the wheel wells of a vehicle.

2.2.2.5

Setting the Initial Control Head ID

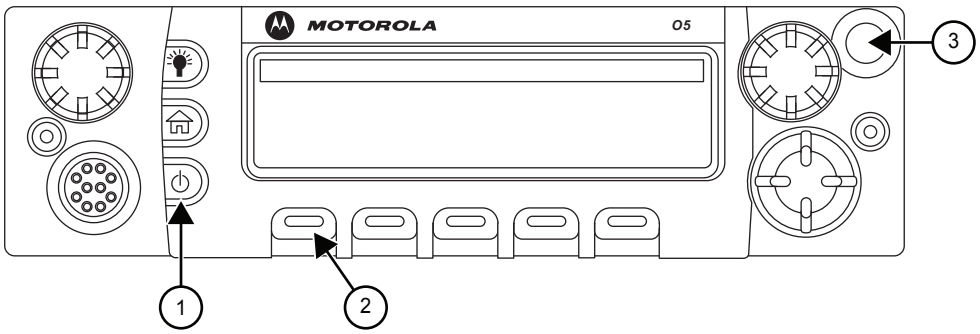
The Front Panel Programming (FPP) mode allows you to define which control head in a Multi-Control Head system becomes control head number 1–4.

Prerequisites: Set the control head ID number for each attached head the first-time Multi-Control Head is used.

Procedure:

1. Press the **Power** button to power off the radio.
2. Simultaneously press and hold the left-most **Soft Menu** key and the **Emergency** button on the control head.

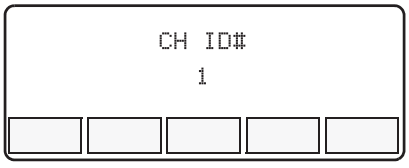
   Figure 66: APX Mobile O5 Control Head Front View



No.	Description
1	Power button
2	Left-most Soft Menu key
3	Emergency button

3. Press the **Power** button to power on the control head.

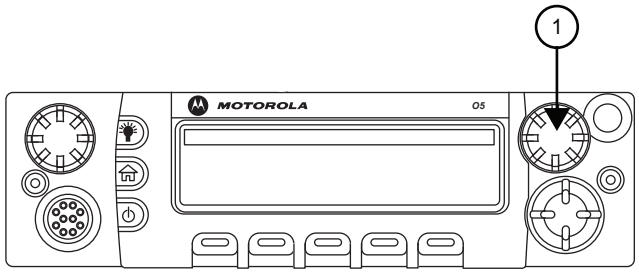
   Figure 67: Radio Display with Current Control Head ID



   The head is powered on into FPP mode and displays the current control head ID number.

4. Turn the **Mode** knob to change the control head ID number.

Figure 68: APX Mobile O5 Control Head Front View – Mode Knob



No.	Description
1	Mode Knob

5. Repeat step 1 through step 4 to set the ID of the remaining control heads.

NOTE: In Multiple Control Head (MCH) installations, the yellow ignition sense wire must be connected to the head assigned ID #1.

2.2.2.6

O3 Control Head and Remote Mount Cabling

Choose a mounting location for the radio, considering accessibility, control, and antenna cable lengths. The control head extension cable and the accessories cable should be installed and routed properly to avoid complications.

Prerequisites: Route the cables in the wiring troughs (where available) of the vehicle or route the cables where they are protected from pinching, sharp edges, or crushing. One suggested route is along one side of the driveshaft hump under the carpet. Use grommets in any holes where the cable passes through metal panels.

Figure 69: O3 Control Head

No.	Description
1	Top
2	Left
3	Front
4	Right
5	Back

The recommended mounting surface for the control unit is on the center console. Figure 71: Hang-Up Clip Installation Exploded View on page 64 shows how the hang-up clip control head, and cables should be installed for the O3 control head.

A mounting clip, which allows the control head to be mounted, is supplied together with the control head.

Procedure:

1. Use the provided mounting clip to determine the location of the two screw holes.
2. Drill 7/16” deep holes for the upper and lower screws.

3. Use the tapping screw provided to install the mounting clip.

CAUTION: Shield the control head (front and back) from direct exposure to pressurized water. The pressurized water from a hose is usually more severe than the stated test and conditions in typical environments.

Figure 70: O3 Control Head Rear View

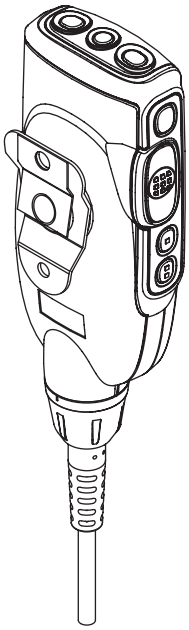
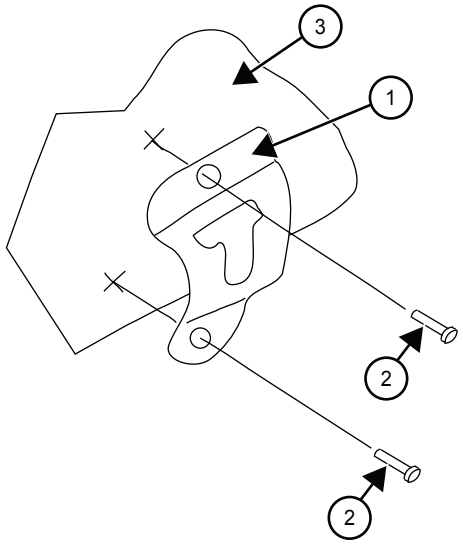


Figure 71: Hang-Up Clip Installation Exploded View



Item No.	Part Number	Description
1	01-80743T91	Mic Hang-Up Clip Assembly
2	03-07644M19	Screw, Machine, 8-32 x 7/16
3	-	Vehicle Mounting Surface

2.2.3
Radio Locking

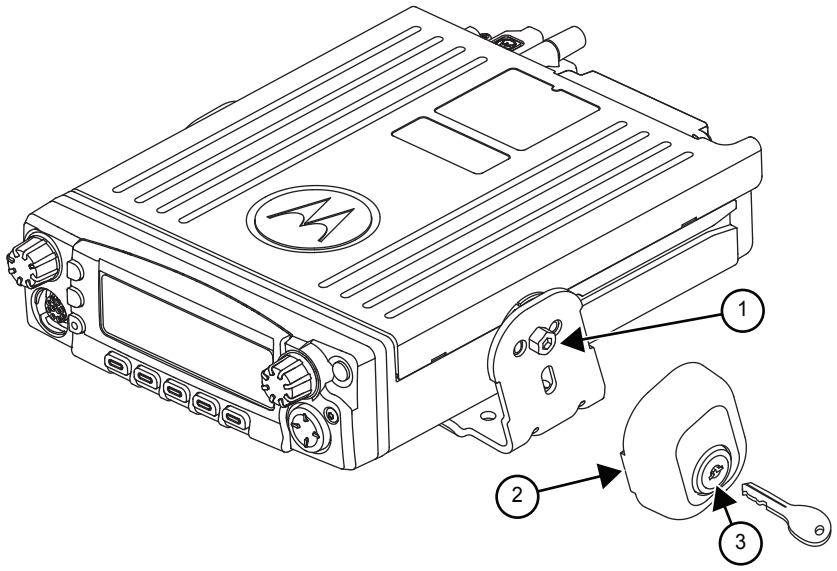
The section describes the radio locking on the trunnion.

2.2.3.1
Locking Kit

Mid Power (Optional)

If an optional locking kit (HLN6372_) is used, position the lock housing on the trunnion after installing the radio mounting screws. Then rotate the lock with the key in it and remove the key to lock the radio. You can install the lock on either side of the radio, and in dash and remote mount installations.

Figure 72: Locking Kit (Optional)



No.	Description
1	Existing Mounting Screw
2	Lock Housing
3	Lock

High Power

The lock comes with every high-power radio. Radios can be inserted into its mounting bracket without the key, but the key is needed to remove the radio.

2.3
Power Cables (Transceiver and Control Head)

Route the RED power cable from both the radio and the control head to the vehicle battery compartment, using accepted industry methods and standards. Be sure to grommet the firewall hole to protect the cable.

Remove the 15 A (part number 6580283E06), 20 A (part number 6580283E07), or 30 A (part number 6580283E09) fuse from the fuseholder and connect the red lead of the radio power cable to the positive

battery terminal using the hardware provided as shown in Figure 73: HKN6188_ Power Cable with External Speaker Connector on page 66 and Figure 74: HKN6187_ Power Cable with External Speaker Connector, Record Audio Output Jack (2.5 mm) and Earphone Jack (2.5 mm) on page 67. Connect the black lead to a convenient solid chassis ground point. DO NOT connect the black lead directly to the battery negative terminal.

Table 9: Power Cables

Description	Part Number
Mid Power Dash Mount	HKN4191_
Mid Power Remote Mount	HKN4192_
High-Power Remote Mount	HKN6110_
O5, O7, and O9 Remote Control Head Power Cable	HKN6188_

2.3.1

O2, O5, O7, O9 or E5 Control Head Power Cables

Figure 73: HKN6188_ Power Cable with External Speaker Connector

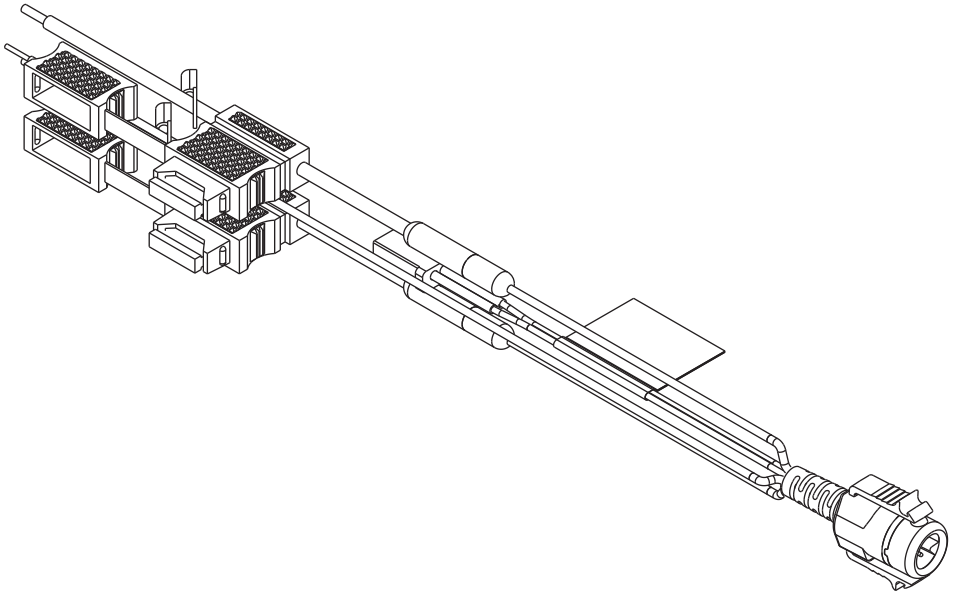
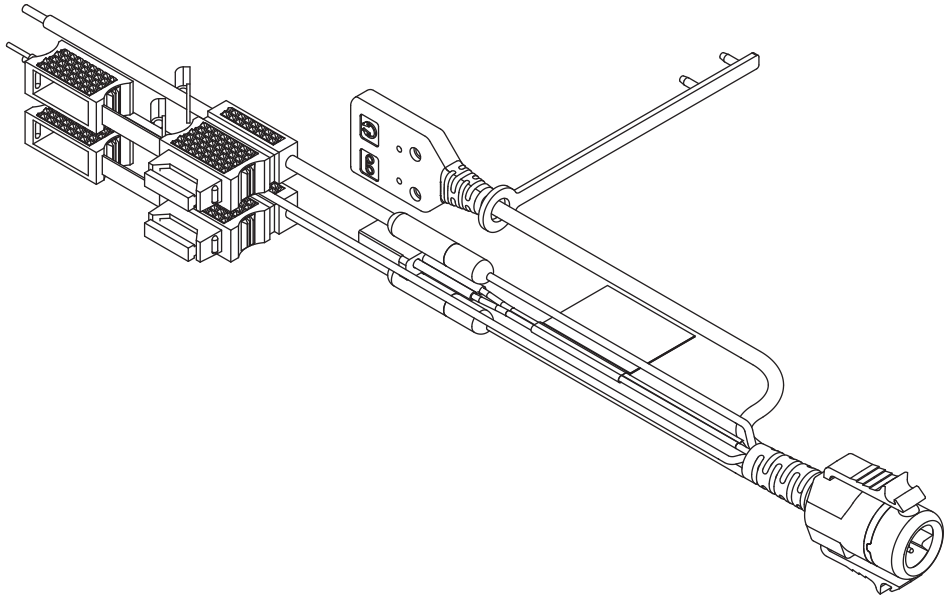


Figure 74: HKN6187_ Power Cable with External Speaker Connector, Record Audio Output Jack (2.5 mm) and Earphone Jack (2.5 mm)



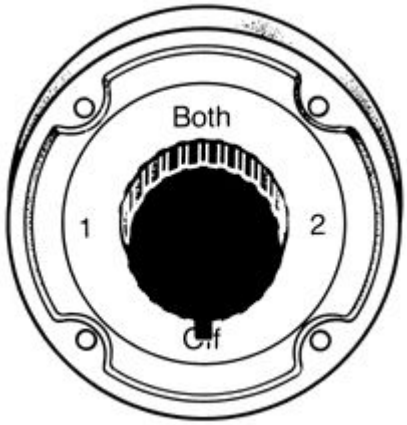
NOTE:
Audio Out – Does not require CPS programming. Attaching a headset mutes the external speakers of the radio which are attached to the SPK jack of the control head.

Record Out – Requires CPS programming. In CPS, navigate to **Radio Wide/Advanced/Record Audio** and select **TX + RX Audio**.

2.3.2 Battery Selector Switch

In vehicles with a Battery Selector Switch, the ignition sense (yellow) wire should be the only wire connected to the Battery Selector Switch. The radio transceiver and control head power wires (red) must be connected directly to the vehicle battery. If the control head power wire and the control head ignition sense wire are both connected to a Battery Selector Switch, but the radio transceiver power lead is not, improper power-cycling and off-state battery drainage may occur. If the desired state of the radio is a total battery drain elimination, then route all power and ignition sense wires through the Battery Selector Switch, so that the control head and radio transceiver both see the loss of battery power at the same time.

Figure 75: Battery Selector Switch



2.4 Antenna Installation

IMPORTANT:
To ensure optimum performance, the guidelines are intended for metal-body vehicles with appropriate ground planes that comply with RF Energy Safety standards.

There is a potential exposure to back seat passengers and bystanders outside the vehicle.

2.4.1 Antenna Installation on a Metal Body Vehicle

You can install the antenna at the following locations:

- External installation – Check the requirements of the antenna supplier and install the vehicle antenna external to a metal body vehicle in accordance with those requirements.
- Roof top – For optimum performance and compliance with RF Energy Exposure regulations, mount the antenna at the center of the roof.
- Trunk lid – On some vehicles with clearly defined, flat trunk lids, you can mount the antennas of some radio models at the center of the trunk lid. For vehicles without clearly defined, flat trunk lids (such as hatchback autos, sports utility vehicles, and pick-up trucks), mount the antenna at the center of the roof. Ensure that the following are observed before installing an antenna on the trunk lid:
  - Ensure that the distance from the antenna location on the trunk lid is at least 85 cm (33 in.) from the rear seat head-rest to ensure compliance with RF Energy Exposure regulations.
  - Ensure that the trunk lid is grounded by connecting grounding straps between the trunk lid and the vehicle chassis.

  CAUTION: If these conditions cannot be satisfied, then mount the antenna on the roof top.

NOTE:
Do not cut the antenna cables to ensure compliance with RF Energy Exposure regulations.

to ensure compliance with RF Energy Exposure regulations, mount the VHF, UHF 1/4 wave antennas, VHF and UHF antennas transmitting above 60 W, and all band antennas only at the center of the roof.

Ensure that the antenna cable can be easily routed to the radio. Route the antenna cable as far away as possible from any vehicle electronic control units and associated wiring.

Check the antenna location for any electrical interference.

NOTE: Any two metal pieces rubbing against each other such as seat springs, shift levers, trunk and hood lids, exhaust pipes, and others close to the antenna can cause severe receiver interference.

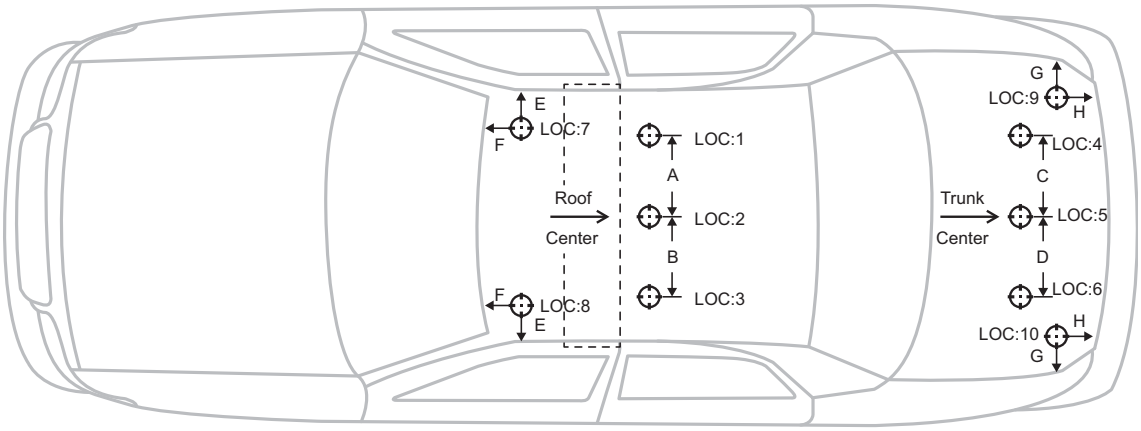
2.4.2

Distance Between Antennas

The following figure indicates the separation distances required for the various antennas used with all mobile radios (except for the APX 8500 mobile radio). Each "cross-hair" symbol represents a possible location (LOC) of an antenna. The recommendation is to locate them as close to the center of the roof and/or trunk as possible, without interference with a lightbar.

NOTE: Do not cut the antenna cable.

Figure 76: Multiple Antennas Separation for locations 1–10



For letters A, B, C, and D, the table indicates the exact distance for separation of the LMR antennas.

For letters E, F, G, and H, the table indicates the maximum distance between the edge of the ground plane and the accessory antenna location.

Table 10: Distance Between Antenna

Characters	Distance
A	8 inches
B	
C	
D	
E	
F	

Characters	Distance
G	
H	

NOTE:

- A minimum of 18 inches separation is required between the lightbar and any roof-mounted antennas to prevent interference with the lightbar circuitry (see lightbar manufacturers installation information).
- If it is a single band mobile radio, LMR antennas should only be placed at the center of the roof (LOC:2) or center of the trunk (LOC:5). If it is a dual band mobile radio, place the LMR antennas at the center of the roof (LOC:2) and at the center of the trunk (LOC:5).
- To ensure compliance with RF Energy Exposure regulations, install VHF and UHF 1/4 wave antenna at LOC:2 (center of the roof only).
- Separate the VML antenna from any LMR antenna by at least 40 inches.
- Install the LTE Main and Diversity Antenna at LOC:9 and LOC:10 when the LMR antenna is only located at LOC:2 for a single band mobile radio, and when the LMR 700/800 antenna is at LOC:2 for a dual band mobile radio (LTE opposite location from the LMR).
- Install the LTE Main and Diversity Antenna at LOC:7 and LOC:8 when the LMR antenna is only at LOC:5 for a single band mobile radio, and when the LMR 700/800 antenna is at LOC:5 for a dual band mobile radio (LTE opposite location from the LMR).
- In some mobile installations that include an LTE modem, external filtering on the LMR port and/or the LTE port may be needed to reduce interference. Contact your local Motorola Solutions Service Center for more information and for filter kit numbers (see Replacement Parts Ordering on page 147 for contact information).
- Install the Wi-Fi/Bluetooth roof mount antenna at LOC:7, LOC:8, LOC:9, or LOC:10. For the installation of glass mount Wi-Fi/Bluetooth antenna, refer to the antenna installation manual.

2.4.3
Multiplexers and Vehicle Installation

The Multiplexer is used if multiple narrow band antennas are preferred.

Figure 77: Multiplexer Motorcycle

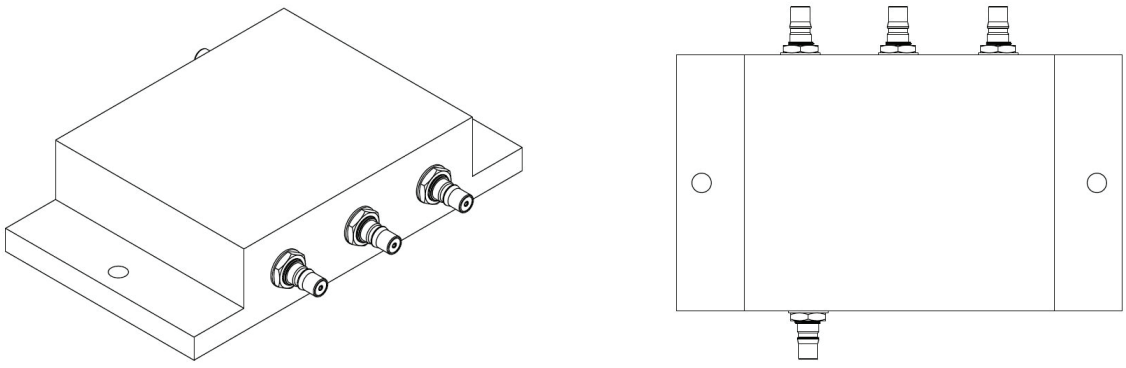


Figure 78: Multiplexer other Vehicles

2.4.4
QMA Connection

The radio uses a quick disconnect connection called QMA. This does not require any tightening.

- Ensure there is sufficient slack in the antenna cable.
- Ensure that the collar of the antenna cable plug does not bind.
- Engage the QMA cable plug onto the jack, listening for a click to ensure proper engagement.
- Gently tug on the cable to ensure that it is engaged.
- To disengage, pull back on the cable plug collar and pull the cable straight off the jack.

2.4.5
GPS/GLONASS/Wi-Fi/Antenna Placement

Figure 79: GPS/GLONASS and Wi-Fi Antenna Connector on the Mid Power Radio

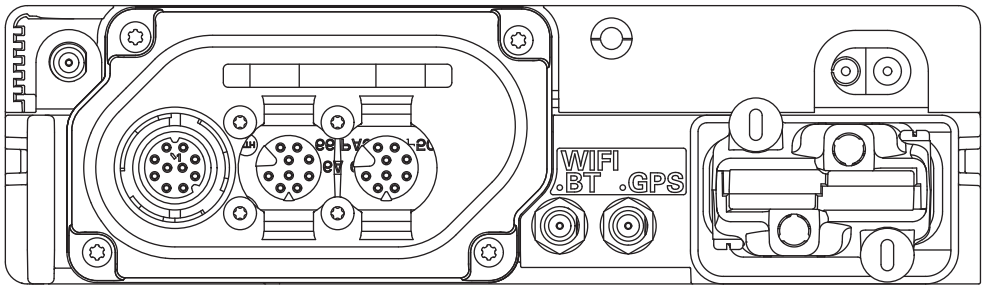
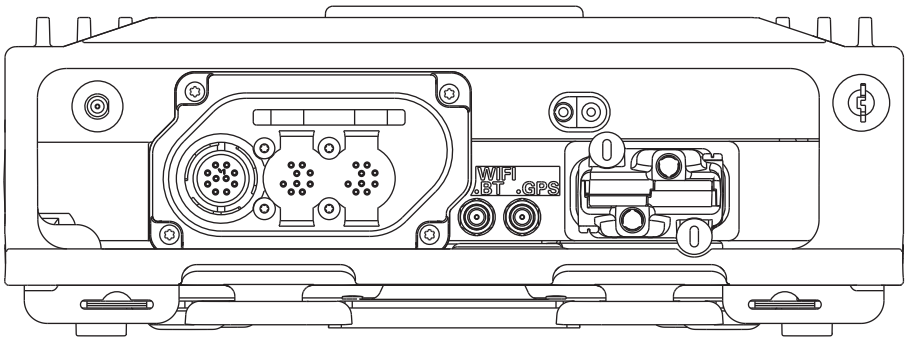


Figure 80: GPS/GLONASS and Wi-Fi Antenna Connector on the High Power Radio



2.5

Installing the Speaker

The speaker kit includes a trunnion bracket that allows the speaker to be mounted in various ways. With the trunnion bracket, the speaker can mount permanently on the mounting surface or in accessible firewall areas. The trunnion allows the speaker to tilt for best operation. Mount the speaker out of the way so that the vehicle occupants cannot kick or knock around it.

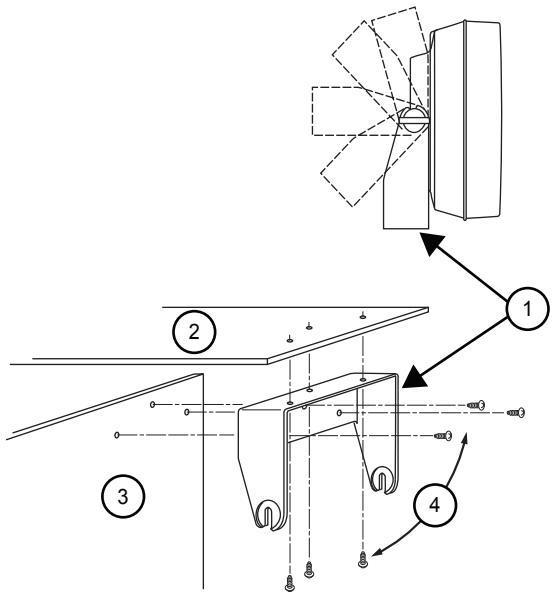
Prerequisites:

⚠ **CAUTION:** DO NOT ground the radio speaker leads. This system has a floating speaker output (DC voltage on both leads); damage to the audio circuit results if either lead is grounded or if they are shorted together.

Procedure:

1. To mark the mounting hole locations, use the speaker mounting bracket as a template.
2. Use the self-drilling screws provided to fasten the trunnion.
3. Attach the speaker and fasten it to the trunnion with two wing screws.
4. Route the speaker wires under the carpet or floor covering, or behind the kick panels. Ensure that the wires are out of the way of the occupants of the vehicle.
5. Do not submerse the 2-pin speaker connector in water nor place this connector in an area that could have standing water.

Figure 81: Speaker Mounting



No.	Description
1	Trunnion Bracket
2	Firewall
3	Dashboard
4	EITHER way

2.5.1
Internal Speaker Disassembly

Prerequisites:

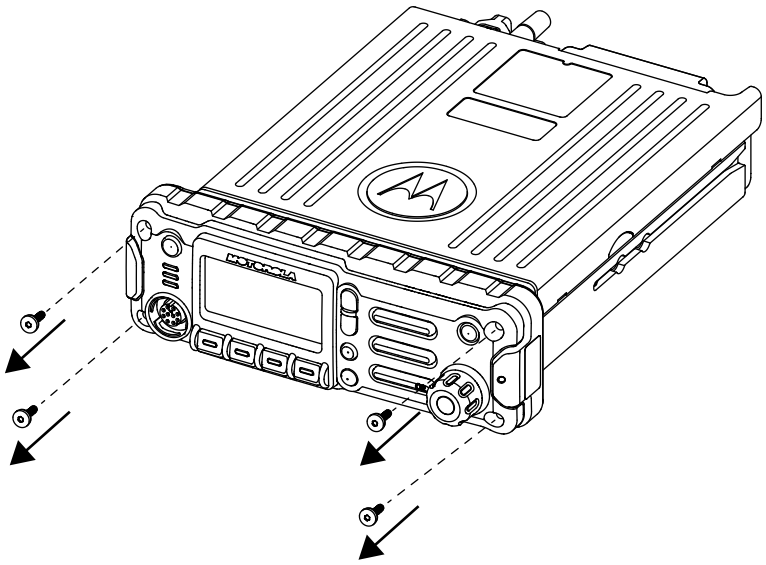
NOTE:
This configuration is only applicable for O2 Control Heads.

Mid power dash mount is shown, but the procedure applies to all configurations and power levels.

Procedure:

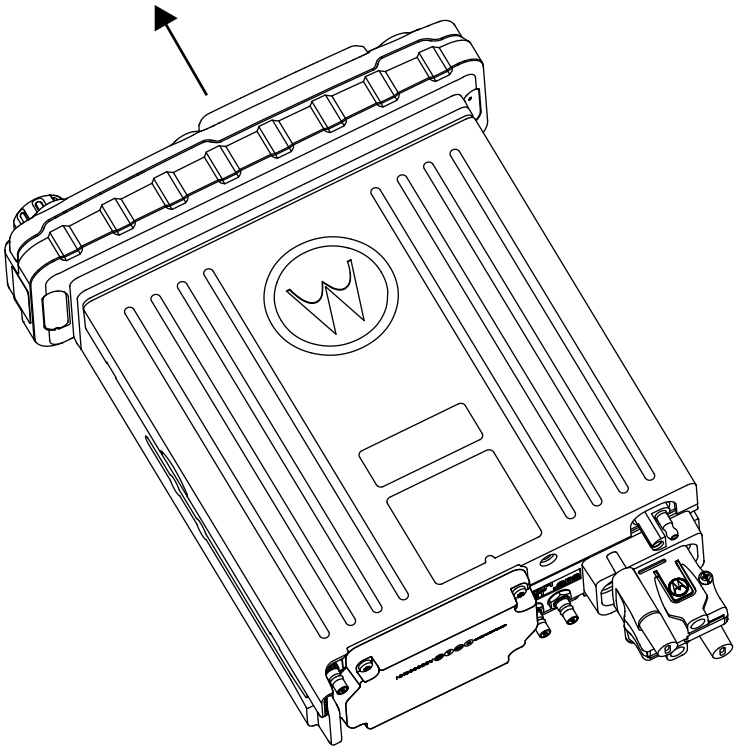
1. Unplug the power, antenna, microphone, and all accessories connections. If the radio is a remote-mount radio, disconnect the remote-mount control cable from the front of the transceiver.
2. Remove the four screws found on the control head with a Torx T-20 bit. Discard the screws.

Figure 82: Removing the screws on the Control Head



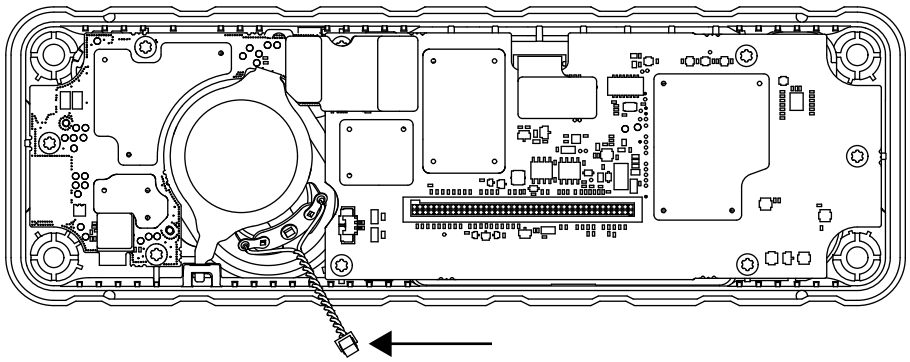
3. Firmly grasp the front panel of the control head. Carefully remove the front housing assembly from the back housing assembly. Note the position of the attached flex and do not pull on it excessively.

Figure 83: Removing the Control Head



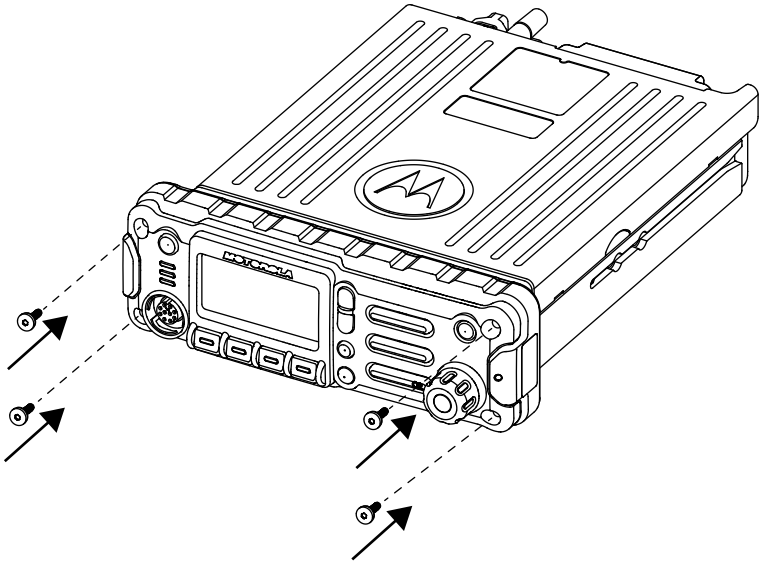
4. Put the control head face down on a clean, flat surface to avoid damaging it. Do not touch the o-ring on the back housing.
5. Carefully disconnect the speaker connector from the circuit board.

Figure 84: Disconnecting the Speaker Connector



6. Reattach the front housing assembly to the back housing assembly. Ensure that the flex is returned to its original position and that the o-ring on the back housing assembly is not pinched.

   Figure 85: Reattaching the Control Head



7. Secure the front housing assembly back to the back housing assembly with four new screws using the Torx T-20 bit. Apply 9 in. lbs. torque for each screw.

2.6
Microphone Hang-Up Clip

This section describes the standard or O3 control head hang-up clip.

The hang-up clip must be within reach of the operator and close enough to the control head to prevent cable strain. Measure this distance before actually mounting the bracket. Since the bracket has a positive-detent action, you can mount the microphone at any position.

To locate the mounting holes, use the hang-up clip as a template. To avoid interference when removing the microphone, install the flathead screw at the top clip hole.

Some microphone models require the grounding of the microphone clip in order for HUB operation to work correctly. Refer to the documentation that comes with your Motorola Solutions microphone model.

NOTE: For multi-control head configuration where only one of the control heads has a microphone, the control heads without a microphone attached must have their HUB or Monitor pin (J100-22) jumpered by a wire to GND (J100-1 or J100-14) for HUB operation to work.

2.7 RFID (Option)

A mobile radio equipped with an RFID tag allows an alternate option to track the radio. Each RFID equipped radio has an RFID tag preprogrammed with the serial number (also found on the FCC label), band, and radio model information of the radio.

Figure 86: RFID Location on Mid Power Radio

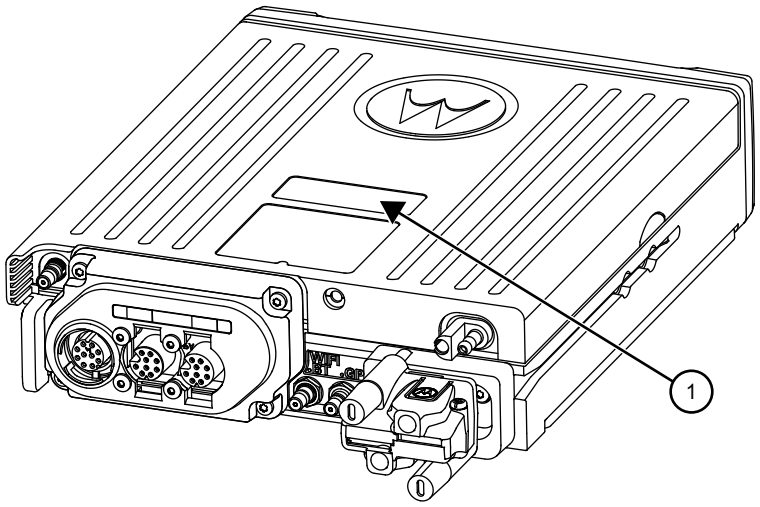
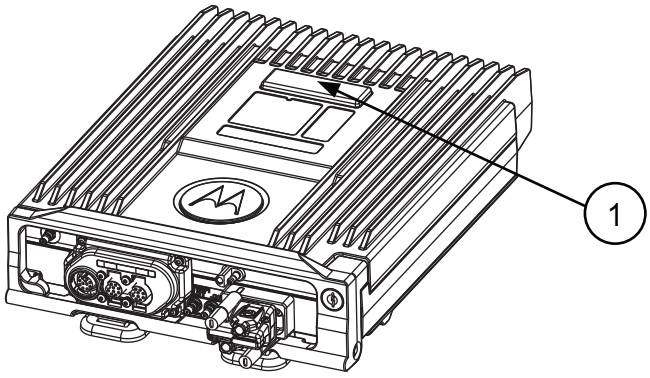


Figure 87: RFID Location on High-Power Radio



No.	Description
1	RFID Tag

2.7.1

RFID Reading

To read an RFID tag using a UHF Gen 2 RFID reader (for example, Motorola Solutions MC9090-G), open an appropriate RFID read application, point the RFID reader at the tag, and activate the RFID antenna of the reader. The RFID reader must be within 1 ft. from the tag to read.

Two variables, Read Angle and Reader Orientation, aid in the distance to read and write the RFID Tag. Read distance is independent of Tag Angle, but the reader should be as close to perpendicular to the tag as possible (Read Angle). As Read Angle increases past 60 degrees, read distance begins to decrease, and the tag becomes unreadable once Read Angle exceeds 90 degrees. RFID tag cannot be read through metal. The orientation of the reader (Reader Orientation) and the tag must be aligned to improve read and writability.

Figure 88: Read Angle for Mid Power Radio

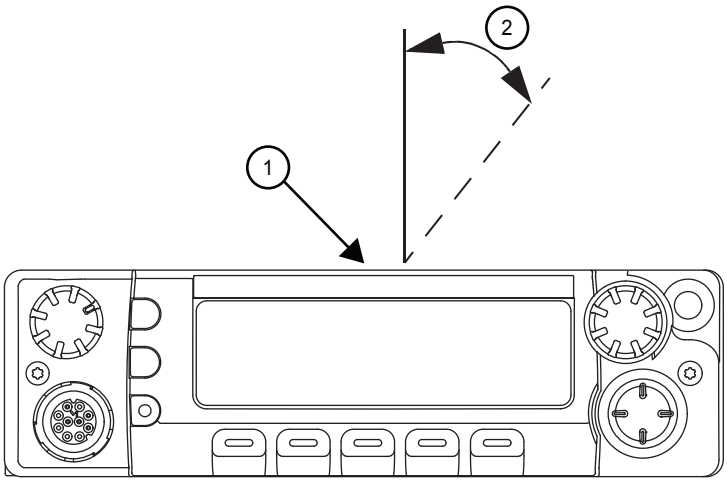
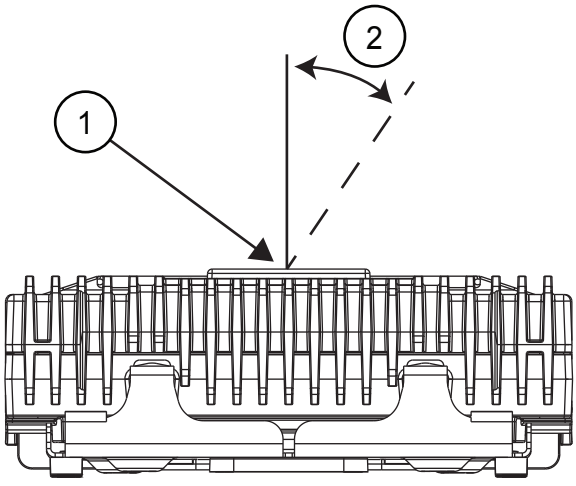


Figure 89: Read Angle for High-Power Radio



No.	Descrption
1	RFID Tag
2	Read Angle

Figure 90: Tag Angle for Mid Power Radio

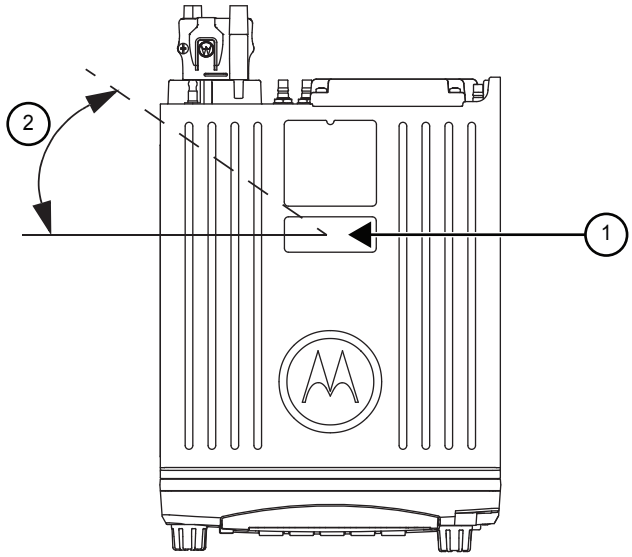
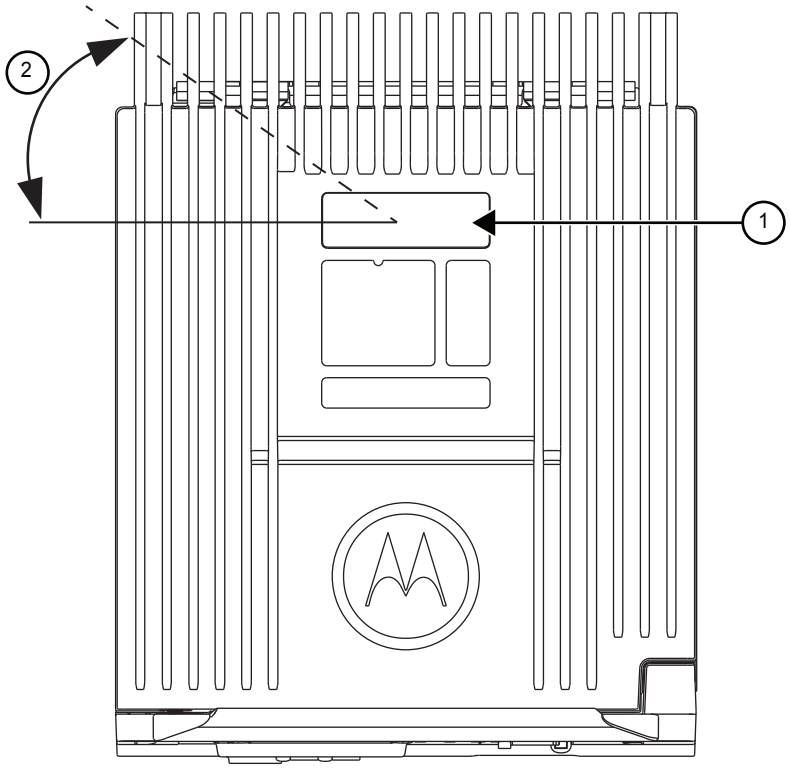


Figure 91: Tag Angle for High-Power Radio



No.	Descrption
1	RFID Tag
2	Tag Angle

Figure 92: Examples of Reader and Tag Aligned (Reader Orientation)

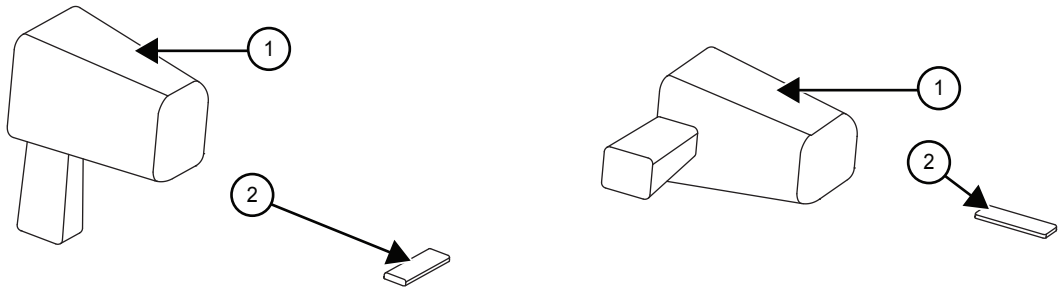
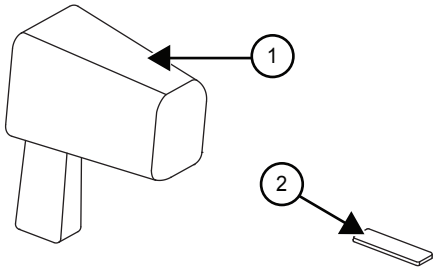


Figure 93: Example of Reader and Tag Misalignment (Reader Orientation)



No.	Descrption
1	Reader
2	Tag

2.7.2

Programming RFID (If Equipped)

Reprogram the tag (up to 12 ASCII characters when encoded to hexadecimal format) by using any UHF Gen 2 capable RFID writer, for example, Motorola Solutions MC9090-G.

NOTE: Follow the read direction in RFID Reading on page 77 to optimize reprogramming.

Table 11: Model Number Chart in 12-Digit ASCII Format

Model Number	Radio Tier/Band/Output Level	Last Two Digits
M37TXS9PW1AN	APX Mobile 700/800 VHF UHF–HP	T0
	APX Mobile 700/800 VHF UHF–MP	
M30KSS9PW1AN	APX Mobile SB-MP VHF	D2
M24KSS9PW1AN	APX Low Tier Mobile-MP VHF	D8
M22KSS9PW1AN		
M36KSS9PW1AN	APX Lowest Tier Mobile-MP VHF	D9
M30KTS9PW1AN	APX Mobile SB-HP VHF	D3
M30QSS9PW1AN	APX Mobile SB-MP UHF1	E2
M30QTS9PW1AN	APX Mobile SB-HP UHF1	E3

Model Number	Radio Tier/Band/Output Level	Last Two Digits
M30SSS9PW1AN	APX Mobile SB-MP UHF2	D2
M20TSS9PW1AN	APX Mobile DB-MP 700/800-MP VHF	R2
M30TXS9PW1AN	APX Mobile DB-MP 700/800-HP VHF	R3
M30URS0PW1AN	APX Mobile SB-MP 700/800	F2
M22URS9PW1AN	APX Low Tier Mobile-MP 700/800	F8
M24URS9PW1AN		
M36URS9PW1AN	APX Lowest Tier Mobile-MP 700/800	F9
M24QSS9PW1AN	APX Low Tier Mobile-MP UHF1	E8
M22QSS9PW1AN		
M36QSS9PW1AN	APX Lowest Tier Mobile-MP UHF1	E9
M24SSS9PW1AN	APX Low Tier Mobile-MP UHF2	E8
M22SSS9PW1AN		
M36SSS9PW1AN	APX Lowest Tier Mobile-MP UHF2	E9
M22WRS9PW1AN	APX Low Tier Mobile-MP 900	F8

Table 12: Serial Number with Radio Band/Tier/Power

Characters	Radio Band/Tier/Power
F	700/800 and 900
D	VHF
E	UHF
R	700/800 and VHF
T	Multi-Band
E	UHF1 and UHF2
S	700/800 and UHF
0	APX 8500
1	APX 7000
2	APX 7500 Mid Power
3	APX 7500 High Power
4	APX 6000
5	APX 6500 Mid Power
6	APX 6500 High Power
7	APX Low Tier Portable
8	APX Low Tier Mobile MP/APX 4500 MP/APX 2500 MP
9	APX Lowest Tier Mobile MP/APX 1500 MP

2.8
Completing the Installation

Follow the following steps to complete the installation.

Procedure:

1. Connect the speaker to the accessory cable.
2. Verify that the ignition sense wire is attached according to planned ignition sense.
3. Verify that the control head is attached to either the TIB or the CAN extension cable.
4. Attach the power cable to the back of the transceiver.

Chapter 3

Universal Relay Controller Installation

The Universal Relay Controller (URC) is an extension of an orderable accessory for O7 or O9 control head.

URC is used to control high power switching peripherals, for example, lightbar. URC works on all power application controlled lightbars. URC is connected to the transceiver GCAI port. The URC design consists of a microcontroller and uses ten relays to control the switching device. A separate ground for isolation exists between the relay and MCU sections, which is provided by the use of iCoupler from Analog Devices. Each relay is connected to an output with 15 A fuse. The maximum load allowed on each output is 12 A. Two cables, each with the maximum of 60 A, can be used to connect to the input connector at the bus bar. Each cable is connected with a 60 A circuit breaker. One-wire EEPROM is employed to enable GCAI to recognize the URC accessory ID. CPS can be used to program the relay patterns.

When installing URC, make sure to plan the installation carefully and leave more room in the front and rear of the box for cabling and accessory connections; and also to the sides of the radio so that you may access and install the trunnion screws.

The recommended mounting location for URC is in the car trunk, either next to the transceiver or within the area not further than 4.5 m away from the transceiver. Ensure that sufficient cooling is provided. Do not cover URC with baggage, blankets, and so on.

CAUTION: Do not backfeed power into URC.

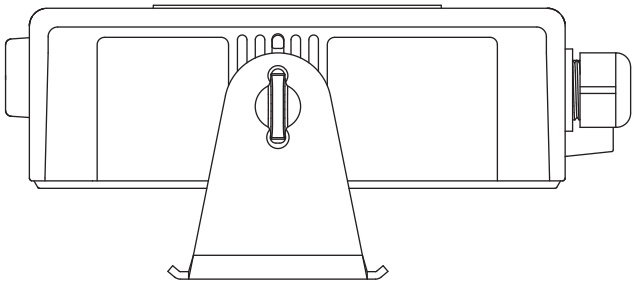
3.1 Universal Relay Controller Mounting

The mounting location must be accessible and visible. Select a location that permits routing the cable as directly as possible.

Prerequisites:

NOTE: For optimum URC performance, orient the mounting trunnion as shown in the following figure.

Figure 94: Universal Relay Controller Orientation



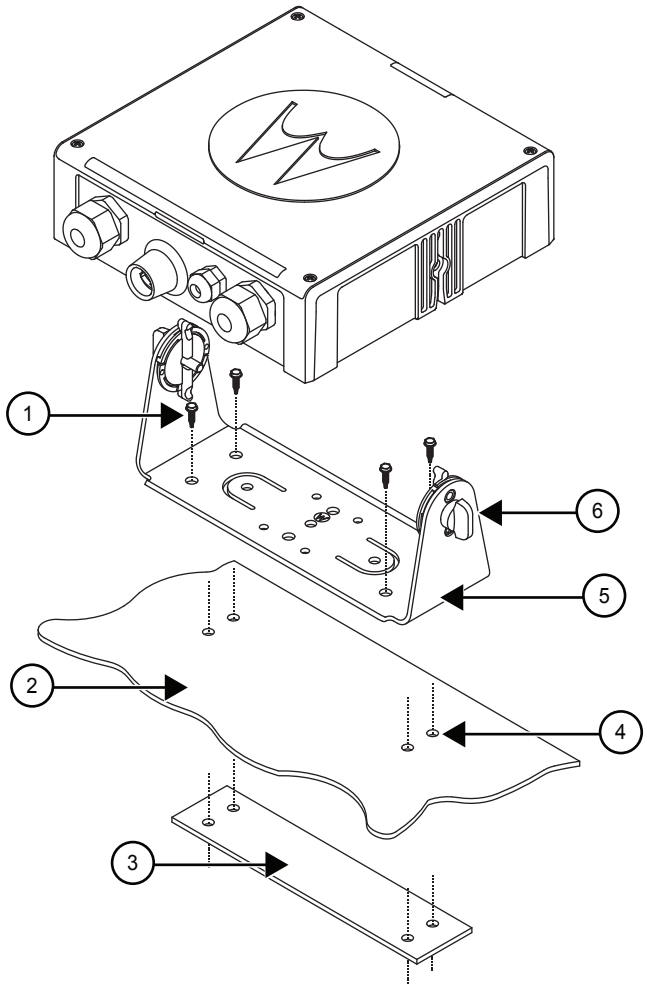
An adjustable trunnion, which allows several mounting positions, is supplied for mounting the URC. The installation must not interfere with the operation of the vehicle or its accessories.

Procedure:

1. Use the URC trunnion as a template to mark the mounting holes. Then, drill 5/32 in. holes. If mounting on a plastic surface, use a metal backing plate.
2. Attach the trunnion bracket using all four 10 – 16 in. x 5/8 in. self-tapping screws provided.

3. Temporarily install the URC (adjust for proper viewing angle) and fasten it to the trunnion with two wing screws. Test the installation to ensure that the unit is securely locked in place.

Figure 95: Universal Relay Controller Installation Exploded View



No.	Description
1	Use four mounting screws on all installations
2	Mounting surface
3	Metal backing plate (not supplied) **IMPORTANT:** Use this plate if mounting trunnion on plastic or unstable surface.
4	Drill four 5/32” holes in mounting surface
5	Trunnion
6	Adjust the universal relay controller to desired angle and secure with wing screws

3.2
O7/O9 Universal Relay Controller Cable Assembly

This sections provides the instruction for URC cable assembly.

3.2.1
Installing the Power Cable

Procedure:

1. Remove the cap nut of power cable gland assembly, and insert the power cable through the cap nut and neoprene seal in the cable gland body. Use power cable with either AWG 6 or AWG 8 only (recommended OD range of cable is 5.5 mm to 9 mm) that is able to withstand 80 A and 50 A respectively, to ensure water sealing of the controller. User can decide to install one or two power cables based on the requirements. The power cables (A+) are not supplied.
2. The loose end of the power cable with cable strip length 7.94 mm (5/16”) is then placed on the power lug and secured down by a set screw. The cap nut is then reassembled with tightening torque 18 lb-in.
3. The other end of the power cable should be connected to circuit breaker (Motorola Solutions part number 40012006001) end which indicates "AUX" and then, to power supply on the other end which indicates "BAT", instead of connecting to power supply directly.
4. Repeat step 1 to step 3 to install the second power cable, if required.
5. If only one power cable is installed, it is recommended to cover the other side of the power cable gland with power cable gland seal with tightening torque 18 lb-in.

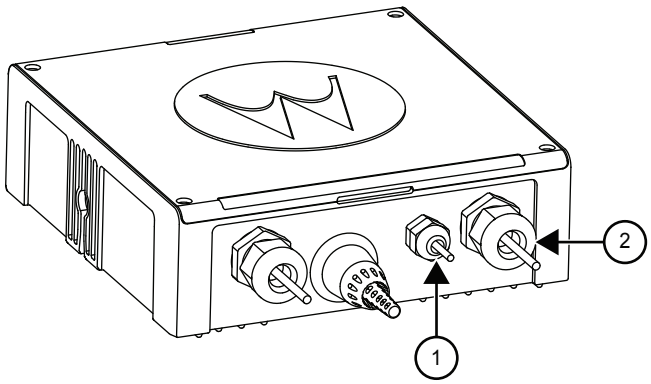
3.2.2
Installing Ground Cable

Procedure:

1. Remove the cap nut of ground cable gland assembly, insert the ground cable through the cap nut, and then reassemble the cap nut. Use ground cable with AWG 14 only (recommended OD range of cable is 2 mm to 4 mm) that is able to withstand 5 A. The ground cables (A+) are not supplied.

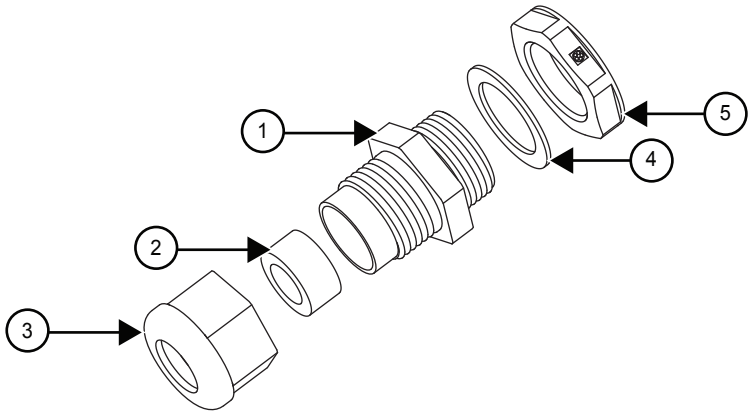
   NOTE: The ground is used to switch the relays, and not act as a ground to the actual device being controlled.
2. The loose end of the ground cable with cable strip length 7.94 mm (5/16”) is then connected to a two-pin terminal block. Both pins on the terminal block are inter-connected and either pin can be used. The cap nut is then reassembled with tightening torque 7 lb-in.

   Figure 96: Power and Ground Cable Glands



No.	Description
1	Ground Cable Gland
2	Power Cable Gland

Figure 97: Cable Gland Assembly with Gasket



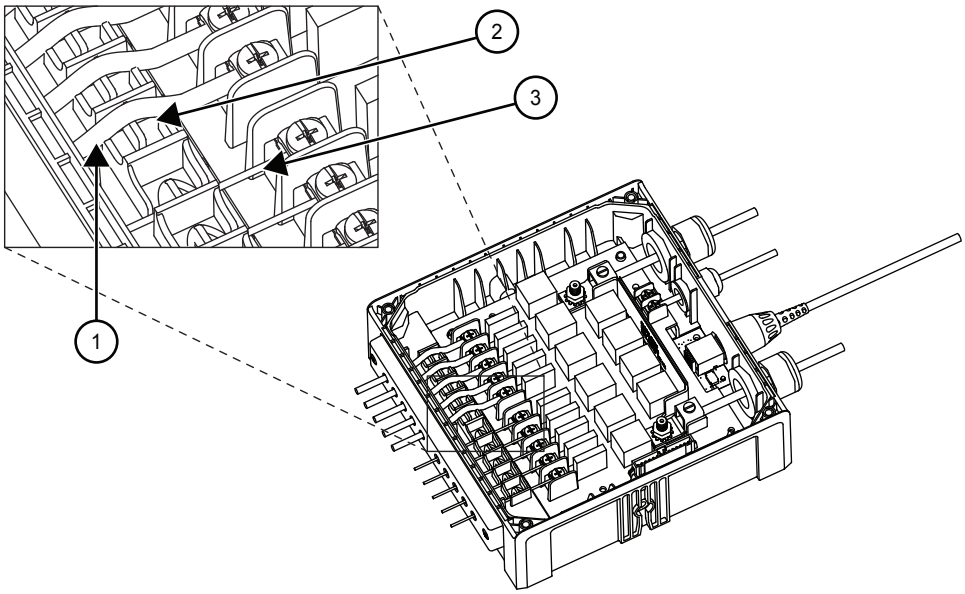
No.	Description
1	Cable Gland Body
2	Neoprene Seal
3	Cap Nut
4	Gasket, Cable Gland
5	Counter Nut

3.2.3
Installing the Wires

Procedure:

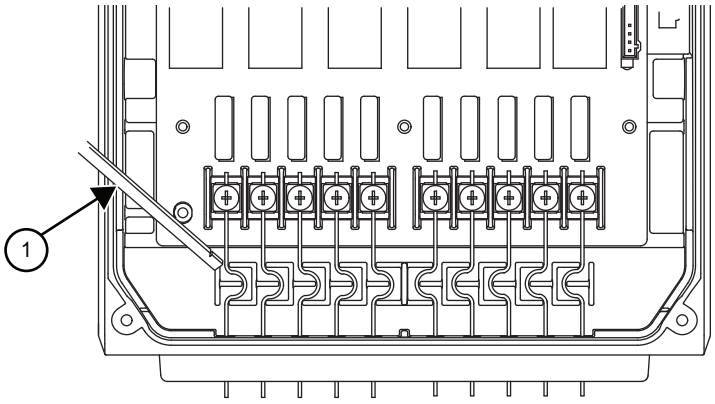
1. Assemble the wires into the lightbar gasket retainer and lightbar gasket. The URC can support lightbars through control wires with outer diameter ranging from 1.52 mm to 3.77 mm (0.06 in. to 0.148 in.), with wire gauges ranging from AWG 12–20.
2. Each individual loose wire (before stripping off the wire jacket) is inserted one at a time through the chassis. Ensure that the lightbar wire is straight before inserting the wire into the chassis. The radial gasket seals each of the wire individually. When a thick wire (for example AWG 14 wire or wire OD > 2.90 mm) is inserted through the chassis, there is potential tearing at the rubber gasket. Remove the rubber gasket residual.
3. Thin wires 2.5 mm and below should be dressed into the retention feature using a black stick. Thick wires above 2.5 mm should be routed above the retention feature. Strip off the wire until 7.94 mm (5/16 in.) after the wire is inserted into the URC, and install the wire into the respective lightbar terminal block.

Figure 98: Wires Installation



No.	Description
1	Lightbar Wire with Diameter above 2.5 mm
2	Lightbar Wire with Diameter 2.5 mm and below
3	Wire Retention Feature

Figure 99: Wire Installation with Black Stick



No.	Description
1	Black Stick

4. Cover the lightbar gasket retainers hole with seal, gasket, and ground cable gland, if no wire is inserted.

5. The lightbar gasket should be replaced at each reassembly of the wire.

   NOTE: Use of other cable gauges except as recommended in this manual may result in water intrusion. Any reassembly of wire needs a new lightbar gasket replaced. If the current loading for one wire is higher than 12 A, the wires should be split before being assembled to the URC system. Wires kit (PMKN4109_) is provided to ease installation of the URC. Incorrect use of the wires kit, for example, improper connection at external loose end wires, may impact the robustness of the URC.

6. Remove the wires and gasket residual inside the URC after the wire installation, before closing the top housing of the URC.

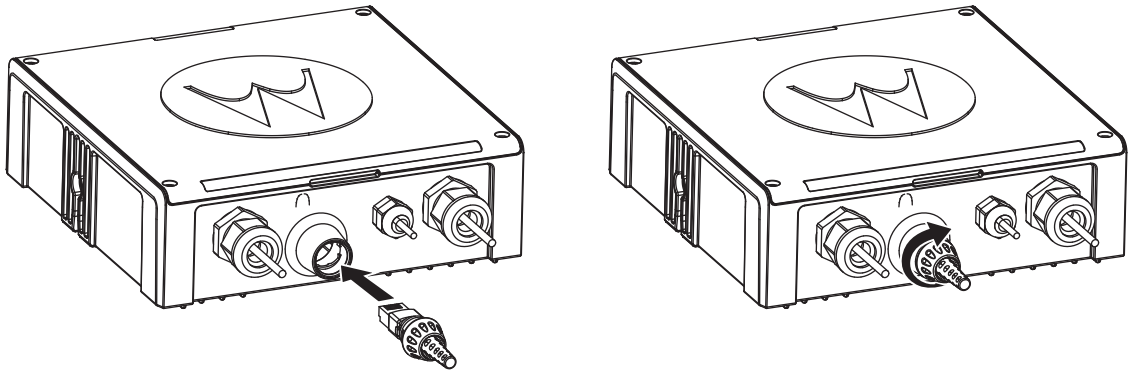
3.2.4
Installing the O7/O9 to URC Cable

The O7/O9 to URC cable (Motorola Solutions part number 3064153H02) can be assembled either before or after reassembling the top housing.

Procedure:

1. Insert the RJ45 port of the cable into the RJ45 connector on the URC and turn the locking collar 90° to the right to ensure that it is locked properly.
2. Test if the cable is locked properly by trying to pull out the cable.

Figure 100: O7/O9 to URC Cable Installation



Chapter 4

Options and Accessories Installation

This chapter provides the options and accessories installation for dash mounted and remote mounted configurations.

4.1 J2 Mid Power Transceiver – Data and Audio Rear Interface

J2 or MAP interface is located at the back of the radio.

The following figure and table illustrate the connector and the function of each pin. Order the Male crimping pin according to the wire gauge for the accessory. Order part number 3980034F05 for 22–28 gauge wire and 3980034F04 for 18–20 gauge wire.

Figure 101: J2 Rear Accessory Connector

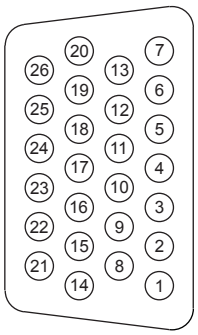


Table 13: J2 Rear Accessory Connector Signal and Voltage Descriptions

Pin #	Pin Name		Pin Function
1	GROUND	Ground	Preferred ground for any digital lines on J2.
2	BUS+ or USB2+	SB9600 BUS+ or USB2+	Part of the Motorola Solutions SB9600 communications bus to connect external devices. It is used for the USB host interface. Defaults to BUS+. Idles at +5 V.
3	BUS- or USB2-	SB9600 BUS- or USB2-	Part of the Motorola Solutions SB9600 communications bus to connect external devices. It is used for the USB host interface. Defaults to BUS-. Idles at 0 V.
4	RS232_TX_9V	RS232 Transmit Data	Part of the 4-wire RS232 interface to the external data accessories, programming cables, and other accessories.

Pin #	Pin Name		Pin Function
5	RS232_RX_9V	RS232 Receive Data	Part of the 4-wire RS232 interface to external data accessories, programming cables, and other accessories.
6	USB-	USB-Data	Part of the 2-wire USB device differential data bus that is used to connect to items such as a programming cable or a modem.
7	USB+	USB+Data	
8	RESET/ USB2_VBUS_H	SB9600 RESET or USB2_VBUS_HOST	Part of the Motorola Solutions SB9600 communications bus to connect to the external devices. In USB Host mode, this signal is the 5 V VBUS supply to a downstream device. Defaults to RESET.
9	BUSY	SB9600 BUSY	Part of the Motorola Solutions SB9600 communications bus to connect to the external devices. Defaults to BUSY.
10	RS232_RTS_9V or AUX_TX	RS232 Request-To-Send or AUX_TX	Part of the 4-wire RS232 interface to external data accessories. An output of normally +9 V no load. It is also known as TX_audio. This pin is an input to the radio. This input is routed to the transmitter through multiplexed lines that are controlled by the microprocessor. Nominal input level is 300 mVrms.
11	RS232_CTS_9V	RS232 Clear-To-Send	Part of the 4-wire RS232 interface to external data accessories. An input normally at +9 V no load.
12	USB_VBUS_D	USB_VBUS_DEVICE	5 V VBUS input for USB connectivity, supplied by the USB Host such as a programming cable.
13	CHAN ACT	Channel Activity	Active low output used to indicate detection or unsquelching of a qualified received signal (idles at 5 V). It can be configured as an optional logic input or output signal.
14	GROUND	Ground	Preferred ground for any of the analog lines on J2.
15	EMERGENCY	Emergency	Input used to detect emergency activation. This pin must be connected to the ground by a cable if emergency is disabled. If enabled, this line must be grounded through a switch that is normally closed.
16	AUX PTT	Push-To-Talk	Pulling this line to ground activates PTT function, normally selecting the AUX_MIC input.
17	ONE WIRE	1-Wire® data	0–5 V bidirectional data used for identification of smart accessories or cables.
18	VIP OUT 1	Vehicular Interface Output	High-voltage open drain output used for enabling relays used for accessories such as horn/lights.
19	VIP OUT 2	Vehicular Interface Output	
20	SPKR+	Speaker +	Used along with SPKR- to connect an external speaker. The audio PA is a bridge amplifier. See

Pin #	Pin Name		Pin Function
			Radio Specifications for speaker impedance and loads.
21	RX FILT AUDIO	Receive Filtered Audio Out	Signal is a fixed level (independent of volume level) received audio signal, including alert tones. Flat or de-emphasis is programmed by the CPS. Output voltage is approximately 100 mVrms per 1 kHz of deviation.
22	MONITOR	Monitor over-rides PL	Active low input used to detect when a rear micro-phone accessory is taken 'off-hook' to over-ride PL to alert the user to busy traffic before transmitting (idles at 5 V). It can be configured as an optional logic input or output signal.
23	AUX MIC or MIC OUT	Rear microphone input or micro-phone output	The nominal input level is 80 mVrms for 60% devi-ation for motorcycle and support 300 mVrms for future APCO accessories. The DC impedance is 1560 Ω and the AC impedance is 560 Ω, 1 Vrms max. 9 VDC with no input load. This pin can be configured as a line level output of the microphone audio in a siren (PA mode) or an external recorder. The nominal amplitude is 75 mVrms.
24	SW B+	Switched Battery Voltage	A+ battery voltage is available when the radio is switched on. Used as supply for certain J2 accessories.
25	IGN sense (ACC)	Vehicle Ignition sense (ACC)	Connecting to the ACC line controlled by the vehi-cle ignition switch that allows CPS ignition features such as “ignition required for turn on” to be used. Connecting this line to the car battery defeats the CPS ignition features.
26	SPKR-	Speaker -	Used with SPKR+ to connect an external speaker. The audio PA is a bridge amplifier. See Radio Spec-ifications for speaker impedance and loads.

4.2
Dash-Mount Accessory Installation (Mid Power)

Installing the dash-mounted accessory must be done by using the accessory connector assembly. It can be found on the rear of the radio, next to the power connector.

Motorola Solutions-approved accessories are supplied with male terminals crimped to a 20-gauge wire. This is designed to fit the plug of the accessory connector assembly.

Insert the male terminal into the accessory connector and connect it to the rear of the accessory port. Do not use other generic terminals in the plug. Generic terminals cause electrical intermittences and may damage the plug.

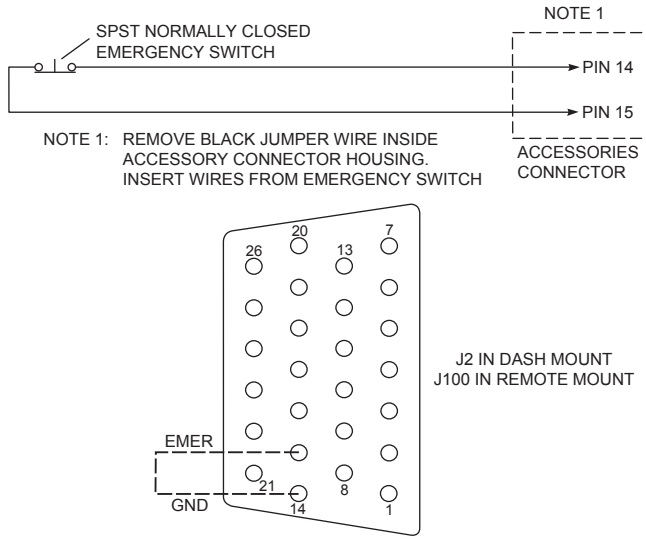
4.2.1

Dash-Mount Emergency Pushbutton or Footswitch Installation

Mount the footswitch using the hardware that comes with the kit. Open the accessory cable connector housing; remove the jumper wire. Connect the emergency switch wires to pins 14 and 15 (see Figure 102: Emergency Switch Wiring Diagram on page 91). Close the connector housing; route the finished cable from the switch location to the control head location.

NOTE: The emergency footswitch should be attached with A+ unattached. A+ should be attached after successfully securing the screws in the connector.

Figure 102: Emergency Switch Wiring Diagram



CAUTION: The radio is sold with correct accessory cables and jumpers to have emergency deactivated by default, regardless of the setting in Customer Programming Software (CPS). However, if cables are not used, or if jumpers are removed without replacing with an emergency accessory button/ switch at one of the accessory ports, the radio powers up upon the application of A+. The display may not show an indication that the radio is on, and this condition can result in an incorrect operation of the radio and excessive current drain of the vehicles battery when the engine is off.

4.2.2

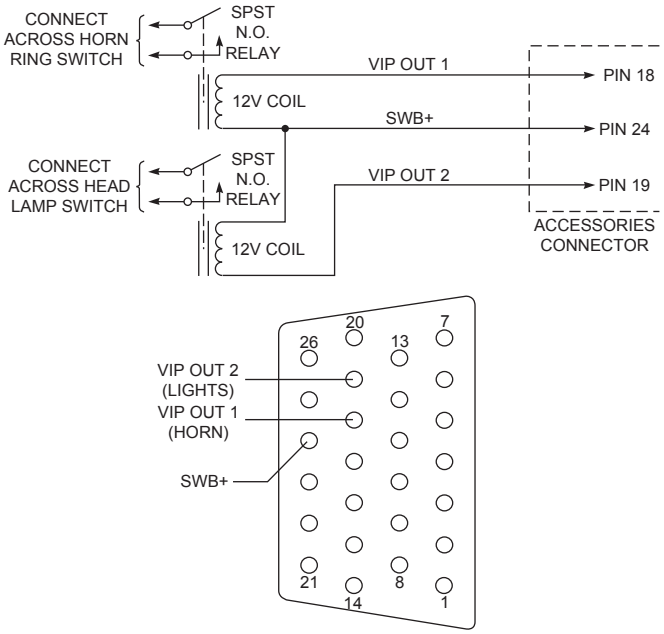
Dash-Mount Horn and Lights (External Alarms) Relays

Prerequisites: For installations that use the horn/lights option, select a suitable location for mounting (normally under the dash). Referring to Figure 103: Horn/Light Wiring Diagram on page 92, perform the following procedure:

Procedure:

1. Horn Relay – Connect the relay contacts across the horn ring switch, typically found in the steering column. Open the accessory cable connector and connect the two control wires (male pins) into locations 18 and 24 of the connector.
2. Lights Relay – Connect the relay across the head lamp ON/OFF switch, typically found in the steering column. Open the accessory cable connector and connect the two control wires (male pins) into locations 19 and 24 of the accessory connector.

Figure 103: Horn/Light Wiring Diagram



4.3

Installing Remote-Mount Accessory

Procedure:

1. Select an appropriate place to mount the option or accessory hardware.
2. Route the accessory-to-control head cables under floor coverings or behind panels so that the vehicle occupants do not snag or break the wires.
3. Attach wires from the accessory to the appropriate wire on the VIP cable (see Table 14: VIP Output Connections on page 98 and Table 15: VIP Input Connections on page 99).

   CAUTION: The radio is sold with correct accessory cables and jumpers to have emergency de-activated by default, regardless of the setting in Customer Programming Software (CPS). However, if cables are not used, or if jumpers are removed without replacing with an emergency accessory button/switch at one of the accessory ports, the radio will power up upon the application of A+. The display may not show an indication that the radio is on, and this can result in an incorrect operation of the radio and excessive current drain of the vehicle battery when the engine is off.

4.3.1

Installing Emergency Pushbutton or Footswitch

When and where to use:

Mount the switch using the hardware that comes with the kit. Connect the button/switch wires to a ground pin and the emergency pin, removing the default jumper wire in the rear accessory cable. The button/switch shorts the pins when inactive. When the button/switch is pressed, its contact opens, the emergency path is ungrounded and pulled-high inside the radio transceiver, and detected by the processor. If an emergency

accessory is used at either (or both) J2 connector and J626 connectors, all jumper wires, shorting emergency to ground, must be removed so the button/switch press can be detected.

4.3.2
Horn (External Alarm) Relay Installation

Mount the horn relay in a suitable location (normally under the dash). Connect the relay contacts across the horn ring switch, typically found in the steering column. Connect the two control wires to a SW B+ pin and a VIP OUT pin on the VIP connector.

4.3.3
Lights (External Alarm) Relay Installation

Mount the light relay in a suitable location (normally under the dash). Connect the relay contacts across the head lamp ON/OFF switch. Connect the two control wires to a SW B+ pin and a VIP OUT pin on the VIP connector.

4.3.4
Gunlock Installation

The O7 or O9 control head can program up to three gunlocks through the programmable buttons.

You can set the time for the momentary trigger using the time-out trigger button. Connect the relay contacts across the gunlock switch to install the gunlock. Connect the two control wires to a SW B+ pin and a VIP OUT pin on the VIP connector.

Install a failsafe or redundant bypass switch for the gunlock. It is suggested to use a separate timer switch or a manual push-on button switch to activate the gunlock. Connect the switch from the supply to the gunlock directly, as shown in Figure 104: Gunlock Switch Redundancy Diagram-Mid Power on page 94 for mid power and Figure 105: Gunlock Switch Redundancy Diagram-High Power on page 95 for high power. Place the manual button at a suitable and reachable location, yet not easily seen.

Figure 104: Gunlock Switch Redundancy Diagram-Mid Power

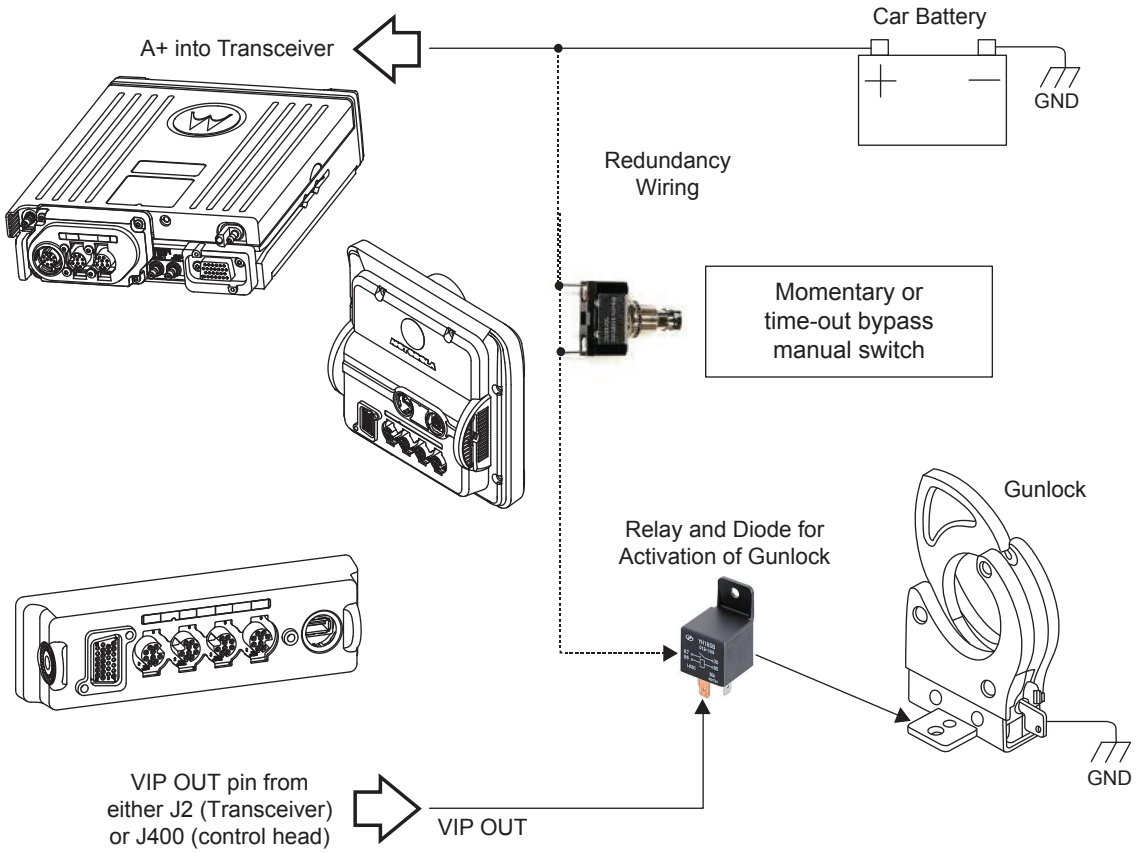
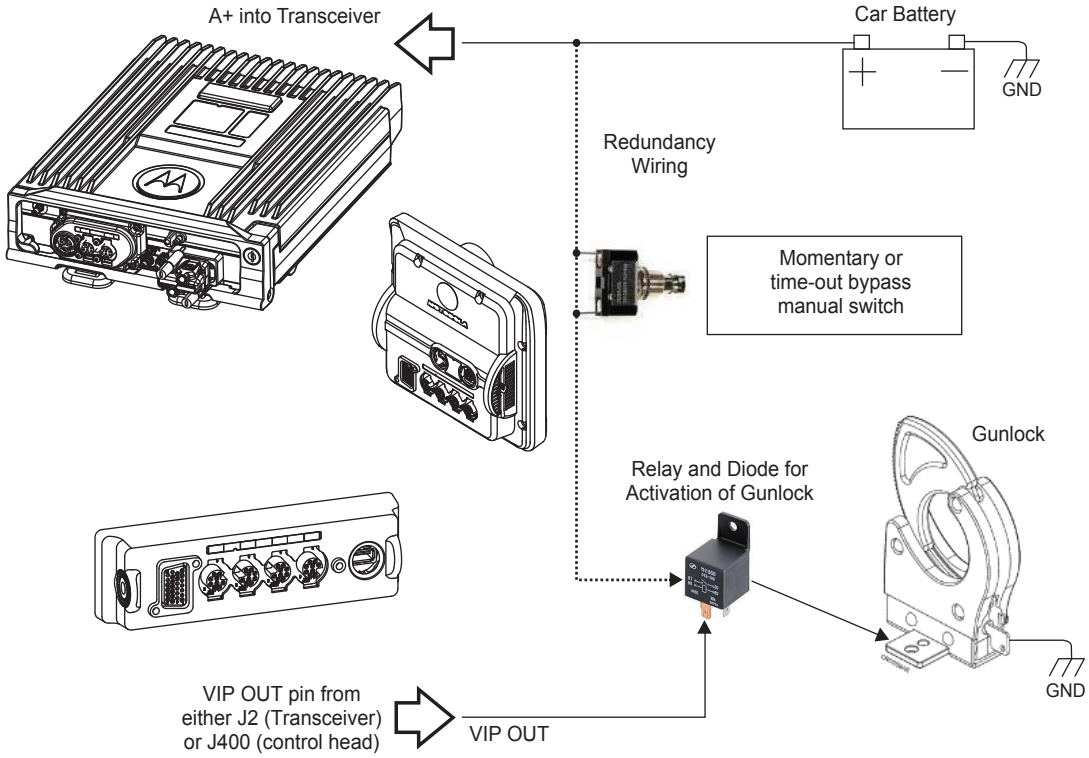


Figure 105: Gunlock Switch Redundancy Diagram-High Power



NOTE: Refer to section VIP Output Connections on page 97 for information related to wiring and activation of VIP OUTs

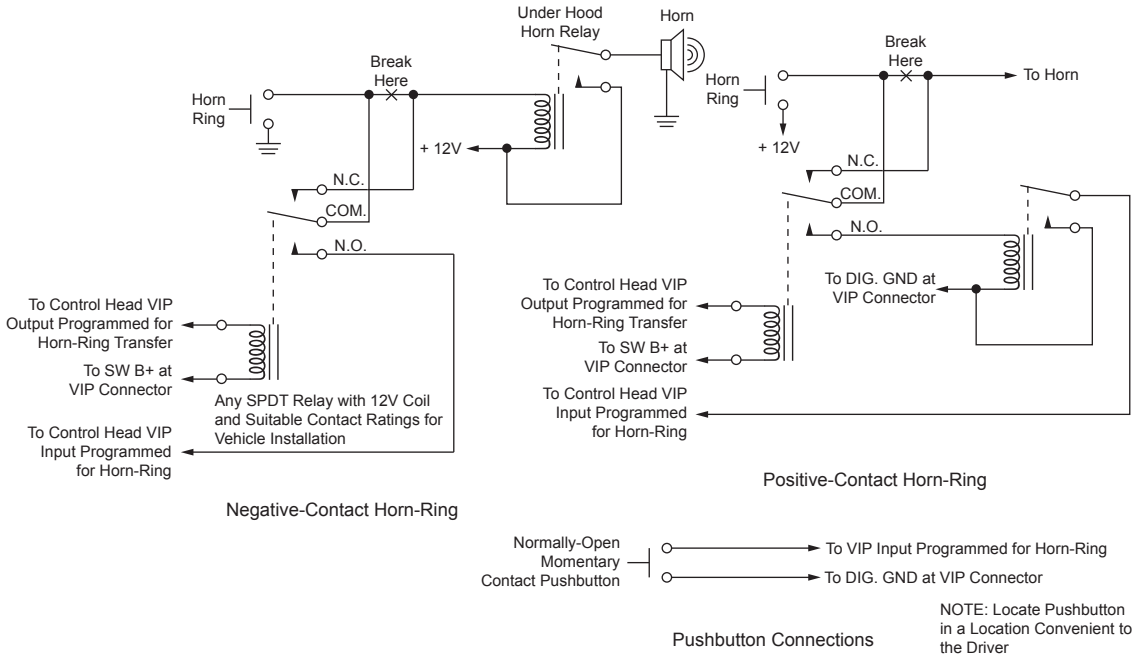
The Y-cable KT000247A01 is primarily designed to allow for simultaneous operation of the Motorola Solutions Branded SB9600 siren and still retain duplicate access to all the MAP (J2) connector pins located on the APX 8500 remote TIB. Use of emergency accessories, speakers, programming cables, VIPS, and others are possible through the P3 connector of Y-cable KT000247A01. The 26 pin connector P2 does not contain every signal from the legacy DB25 port, called J600 on the APX 7500. Therefore, some legacy functionality that is A+ is reduced with the APX 8500 remote mount configuration compared to the APX 7500 remote mount configuration.

4.3.5
Horn-Ring Transfer

Configure the Horn Relay for either Negative Contact or Positive Contact as shown in “section 6.3” of the siren/PA manual (6881093C18).

Program the designated VIP-OUT line for “Horn-Ring Transfer” and program the designated VIP-IN line for “Horn-Ring”. Figure 106: Siren/PA Horn-Ring Connections on page 96 shows wiring diagrams for connecting the Horn-Ring through a transfer relay for both negative and positive ground systems. Refer to the siren/PA manual (6881093C18) for more information.

Figure 106: Siren/PA Horn-Ring Connections



4.3.6
Record Audio Out Jack of Transmit and Receive Audio

The use of Power Cable kit HKN6187_ (see Figure 74: HKN6187_ Power Cable with External Speaker Connector, Record Audio Output Jack (2.5 mm) and Earphone Jack (2.5 mm) on page 67) provides access to both the transmitted and the received audio speech. This audio can be recorded with a standard tape recorder using a 2.5 mm connector.

4.3.7
Earphone Jack

The use of Power Cable kit HKN6187_ (see Figure 74: HKN6187_ Power Cable with External Speaker Connector, Record Audio Output Jack (2.5 mm) and Earphone Jack (2.5 mm) on page 67) allows the use of a standard earphone/headset instead of the external speaker. Once a cable is plugged into this 2.5 mm jack, the external speaker attached at the control head turns mute.

4.3.8
USB Data Cables

The USB 1.5 m data cable HKN6163_ is recommended for both dash (at J2 connector) and remote (at J100 connector) mount configurations. The cable includes an emergency jumper, which is necessary for correct dash mount configurations.

For interfacing at the MMP port, use Cable HKN6184_ that is a USB device cable. The USB 4 m (15 ft.) data cable HKN6172_ is recommended for connections to the J2.

If the customer intends to use the HKN6172_ for connections to the J2, the cable 26-pin connector must be opened and an emergency jumper-wire placed across pins 14 and 15. Refer to Figure 102: Emergency Switch Wiring Diagram on page 91.

4.3.9
RS232 Cables

RS232 cables are not compatible with Customer Programming Software (CPS) radio reading or programming. It can be used for interfacing with RS232 accessories or RS232 computer programs.

The followings are the RS232 cables:

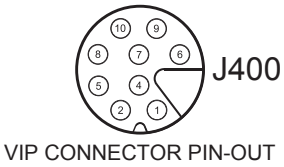
- HKN6160_ is a 6 feet dash RS232 cable from J2 connector
- HKN6161_ is a 20 feet dash RS232 cable from J2 connector

4.4
Vehicle Interface Port Overview

The Vehicle Interface Port (VIP) allows the control head to operate outside circuits and to receive inputs from outside the control head. There are three VIP outputs which are used for relay control. There are also three VIP inputs which accept inputs from switches (remote mount only).

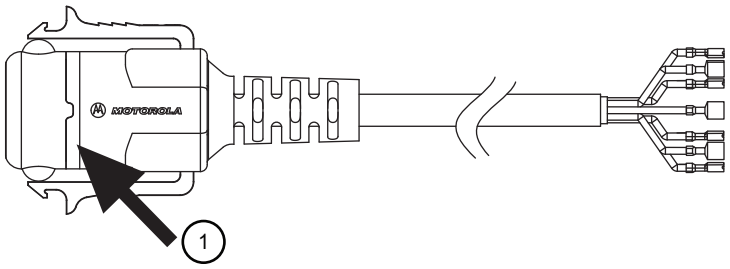
Figure 107: Remote Control Head Pinouts

Radio Pin Number	VIP Cable (HKN6196_) Wire Color	Function
J400-1	RED	SWB +
J400-2	GREEN	GND
J400-3	-	NO PIN
J400-4	-	"VIP" detect: GPIO=HIGH
J400-5	BLUE	VIP_OUT_1
J400-6	YELLOW	VIP_OUT_2
J400-7	BLACK	VIP_OUT_3
J400-8	WHITE	VIP_IN_1 (VIP_IN GPIO)
J400-9	ORANGE	VIP_IN_2 (VIP_IN GPIO)
J400-10	VIOLET	VIP_IN_3



VIP CONNECTOR PIN-OUT

Figure 108: HKN6196_ VIP Connector Detail



No.	Description
1	Yellow Ring

4.4.1
VIP Output Connections

The VIP output pins are on the back of the control head (J100 and J400), or the rear accessory port (J2), as shown in Wiring Diagrams.

Use these connections to wire control relays. One end of the relay should connect to switched B+ voltage, while the other side connects to a software controlled ON/OFF switch inside the control head. The relay can be normally on or normally off depending on the configuration of the VIP outputs. There are three VIP output connections, as follows:

Table 14: VIP Output Connections

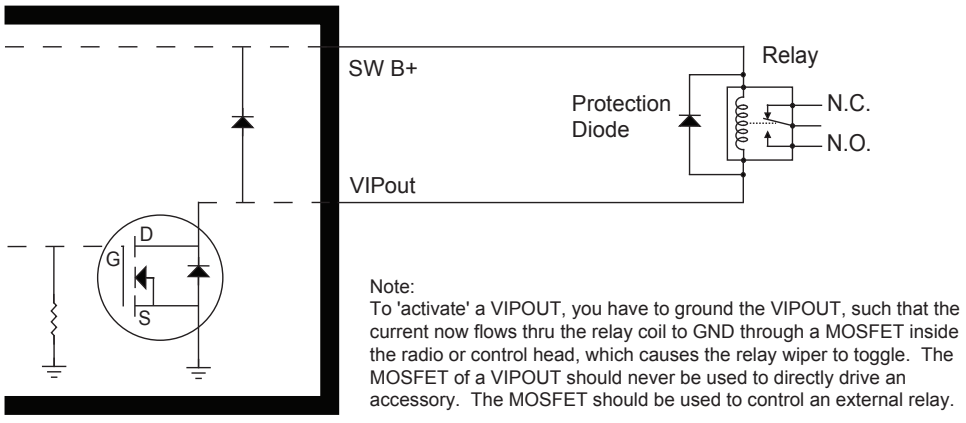
VIP OUT NUMBER	J400		J2		J100	
	SW B+ Pin Number	On/Off Switched Pin Number	SW B+ Pin Number	On/Off Switched Pin Number	SW B+ Pin Number	On/Off Switched Pin Number
1	Red 1	5 (Blue)	24	18	24	18
2	Red 1	6 (Yellow)	24	19	24	19
3	Red 1	7 (Black)	NA	NA	NA	NA

The function of these VIP outputs can be field programmed in the control head. Typical applications for VIP outputs are external horn/lights alarm and horn ring transfer relay control. For further information on VIP outputs, see the control head programming manual.

VIP OUT 1 and VIP OUT 2 can be accessed from either J100 or J400 connectors to allow a previously wired VIP OUT at J2 to move easily to J100. However, when any cable is inserted into J400, J100 VIP OUTs are disabled.

When installing relays to the VIP OUT lines, a diode is necessary to prevent damage to the transistor or MOSFET, due to “back EMF” when the field collapses on the relay coil. Some vendor relays already come with this diode built-in, and other relays require the customer to install it. Figure 109: Relay Coil on page 98 shows the proper placement of the diode across the relay coil. The transistor or MOSFET is located inside the radio or the D.E.K. box.

Figure 109: Relay Coil



NOTE: See Replacement Parts Ordering on page 147 to order relay for your VIP OUT applications. Example relay hardware: TLN4533_ (relay without internal diode), HLN6969_ (relay with internal back EMF protection diode), and HKN4258_ (relay wiring cable).

4.4.2
VIP Input Connections

The VIP input pins are only available on the back of the control head (remote mount).

These connections control inputs from switches. One side of the switch connects to ground while the other side connects to a buffered input on the control head. The switch can be normally closed (NC) or normally open (NO) depending on the configuration of the VIP inputs. The following are the three VIP input connections:

Table 15: VIP Input Connections

VIP IN NUMBER	J400		J2	
	Ground Pin Number	On/Off Switched Pin Number	Ground Pin Number	On/Off Switched Pin Number
1	2 (green)	8 (white)	NA	NA
2	2 (green)	9 (orange)	NA	NA
3	2 (green)	10 (violet)	NA	NA

NOTE: Remote Mount requires the VIP cable to be attached to J400.

MCH installations require the VIP inputs to be connected to the head assigned ID #1. See Setting the Initial Control Head ID on page 61 for further information.

CAUTION: ASTRO mobile radios equipped with the following features are able to transmit automatically, even if the radio is turned off:

- Automatic Vehicle Location
- Other Special Data Products

All ASTRO mobile radios have accessory connector pins 14 and 15 connected together to allow the radio to power down. Opening this connection by removing the accessory connector, or otherwise failing to maintain a normally closed path, could, if left unchecked, drain the vehicle battery, and possibly cause transmissions to occur.

4.5 Accessory Connector Assembly Details (P2)

The APX mobile accessory connector assembly is mounted on the right rear of the radio on mid power and the right front of the radio on high power, opposite the antenna and next to the power connector.

It is fastened to the radio via jackscrews and held together by the two cover screws. It is a multi-functional connector that allows for many different types of adaptations. All approved accessory wires are securely strain-relieved through the exiting slots at the back of the accessory connector assembly. The terminations that are supplied with all accessories are fully engaged and locked into the plug connector (6680163F01). They can also be detached for service with the assistance of a terminal removal tool. The accessory connector assembly can be serviced multiple times for future installation upgrades.

For mid power, the accessory connector assembly, supplied with every APX mobile dash-mounted radio, is equipped with a 26-pin plug assembly, two covers, two jackscrews, two cover screws, one emergency jumper, one ignition sense cable assembly, and one speaker pigtail. The jumper is provided to complete the circuit for emergency mode. If this circuit becomes open, the radio is set to emergency mode.

3980034F05 is the crimping pin part number for use with any wires used inside the accessory cable connector.

4.5.1
Disassembly and Assembly of Accessory Connector

This section provides the detailed disassembly and reassembly of accessory connector.

4.5.1.1
Disassembling Accessory Connector

Procedure:

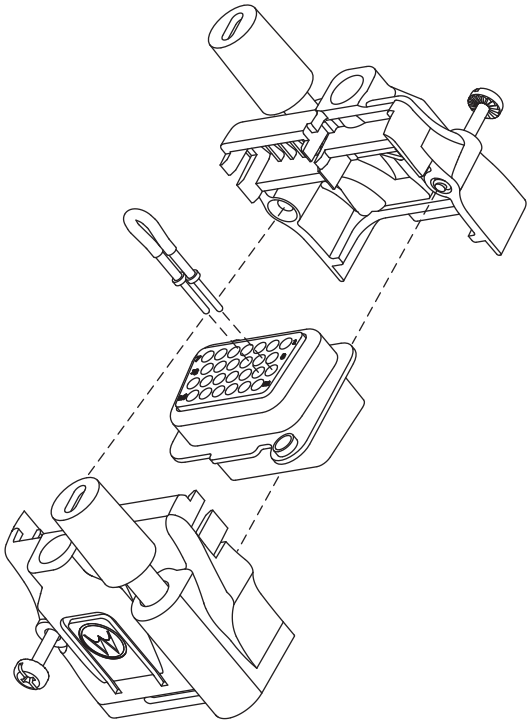
1. Disconnect the negative terminal from the vehicle battery. Make sure that the battery cable is secured such that it cannot power the vehicle electrical system.
2. Unscrew both jackscrews completely.
3. Pull the accessory connector assembly out from the radio.
4. Loosen both cover screws, but do not remove them completely.
5. Pull the jackscrews away from the plug and hold them back.
6. Pry apart the accessory connector assembly covers.
7. Attach any new wire to its proper location by pushing in the male terminal. When you hear a pop, the wire is engaged. To verify that the wire is engaged, tug gently on the wire and be sure that it does not come out. To avoid severe damage to the plug, do not overload the wire.

4.5.1.2
Assembling Accessory Connector

Procedure:

1. Place the plug-in one cover. Be sure that the flange of the plug is in the slot of the cover.
See Figure 110: Exploded View of Accessory Connector Assembly (HLN6863_) on page 101.
2. Push the jackscrew through the plug to hold it in.
3. Position each wire across the strain-relief features in the cover. Avoid damaging loads on the plug by allowing some slack in each wire in the accessory connector wire chamber.
4. Place the second cover onto the plug. Be sure that the flange is protruding through both covers.

Figure 110: Exploded View of Accessory Connector Assembly (HLN6863_)



5. Squeeze the covers together bending the wires in the strain-relief features. You may need a pair of pliers to seat the assembly covers.
6. Once the covers are fully seated, fasten them with the cover screws. Tighten the screws firmly but do not over-tighten them. Be sure that none of the wires are pinched.
7. Reattach the accessory connector assembly to the back of the radio and fasten it by finger-tightening the jackscrews to prevent any loosening.

NOTE: See for detailed descriptions of these pins and other connectors located in the mobile radio.

4.6 Motorola Solutions Branded SB9600 Siren Connection to APX 8500

The Y-cable KT000247A01 is primarily designed to allow for simultaneous operation of the Motorola Solutions Branded SB9600 siren and still retain duplicate access to all the MAP (J2) connector pins located on the APX 8500 remote TIB

Figure 111: J600 Accessory Connector Y-Cable KT000247A01

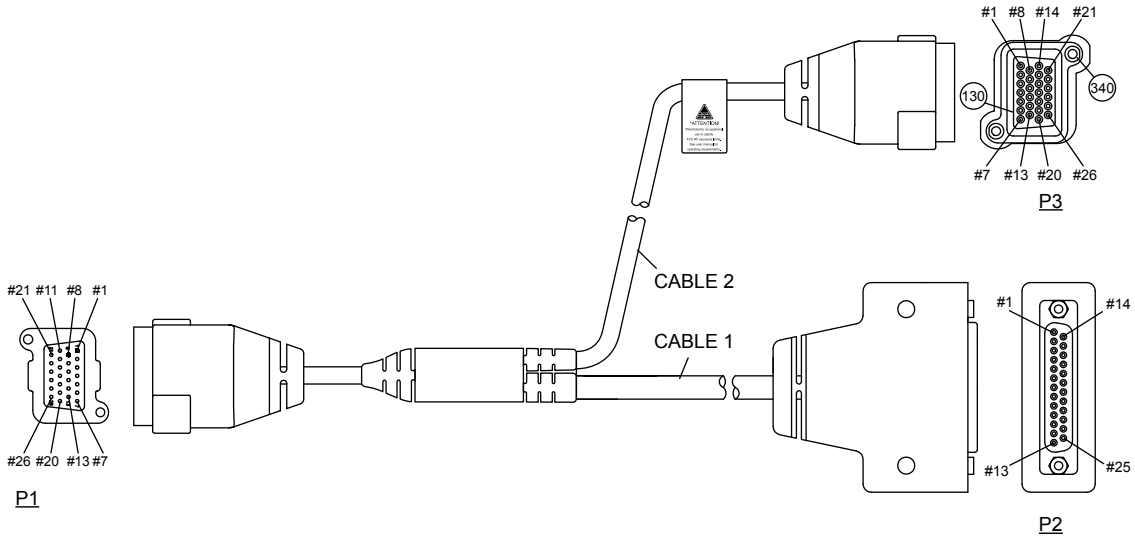


Figure 112: Pinout for cable KT000247A01

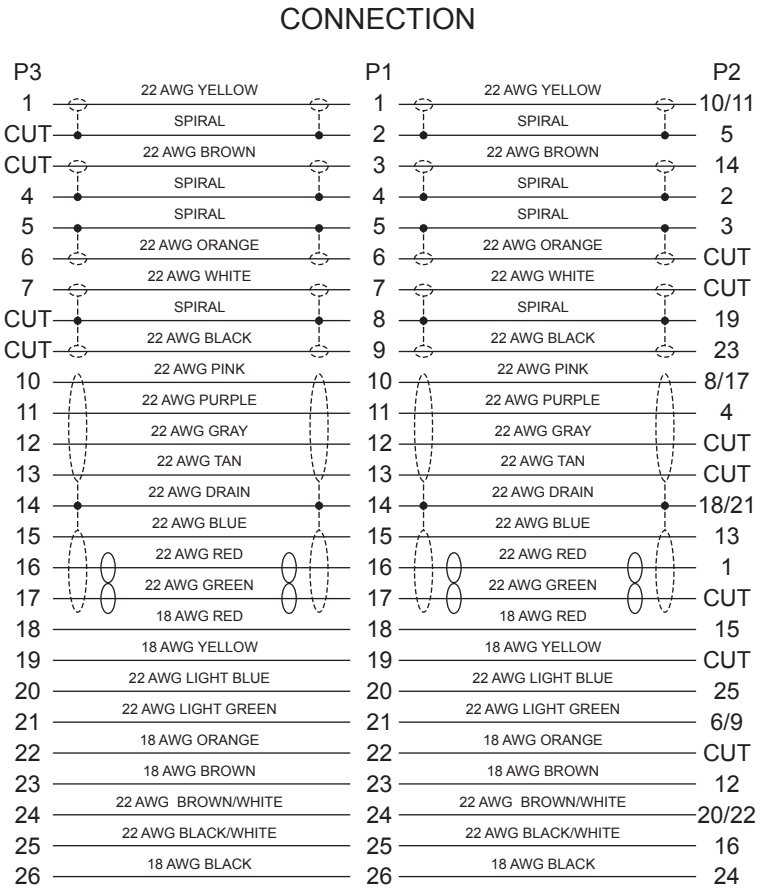
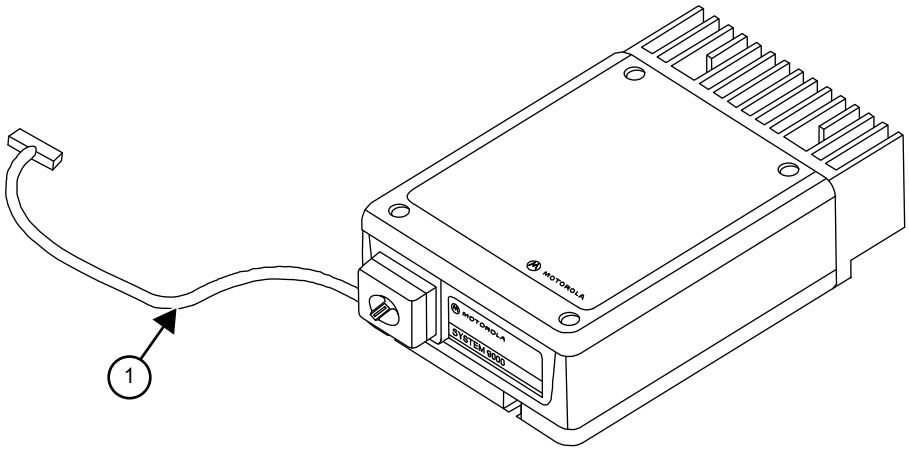


Figure 113: Interfacing the Y-cable to the Motorola Solutions Branded SB9600 Siren and External Accessories



Use of emergency accessories, speakers, programming cables, VIPS, and others are possible through the P3 connector of Y-cable KT000247A01. The 25 pin connector P2 does not contain every signal from the legacy DB25 port, called J600 on the APX 7500. Therefore, some legacy functionality that is A+ is reduced with the APX 8500 remote mount configuration compared to the APX 7500 remote mount configuration.

NOTE: Only USB 1.5 meter data cable HKN6163_ is approved for use in series with the Y-cable KT000247A01 at connector P3. USB 4 meter data cable HKN6172_ is not approved for use in series with the Y-cable at connector P3.

4.7 Motorola Solutions Range Extension Connection to APX8500

The Y-Cable KT000247A04 looks similar to KT000247A01. While KT000247A04 connects with APX8500 in the same way as KT000247A01, KT000247A04 functions differently. KT000247A04 removes SB9600 functionality and supports USB Host at the MAP 26-pin connector. This functionality enables the use of a USB-based LTE modem at P3 terminal.

Figure 114: Range Extension Connector Y-Cable KT000247A04

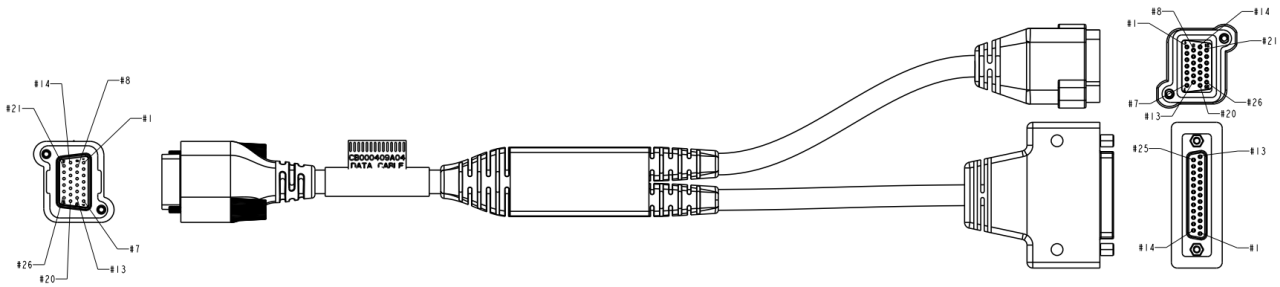


Figure 115: Pinout for Cable KT000247A04

TABLE 10: CB000409A04 WIRING DIAGRAM

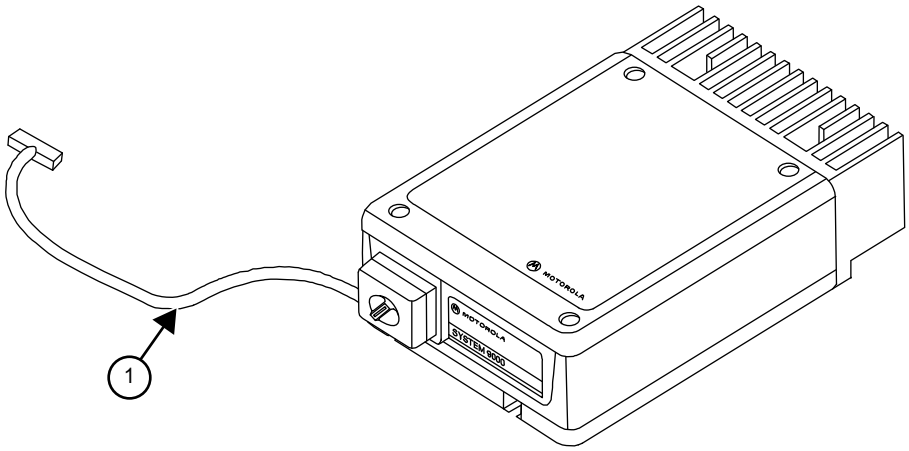
MALE TERMINALS (P1)	FEMALE TERMINALS (P2 OR P3)
1	10, 11 (P2)
	1 (P3)
2	2 (P3)
3	3 (P3)
4	2 (P2)
	4 (P3)
5	3 (P2)
	5 (P3)
6	6 (P3)
7	7 (P3)
8	8 (P3)
10	8, 17 (P2)
	10 (P3)
11	4 (P2)
	11 (P3)
12	12 (P3)
13	13 (P3)
14	18, 21 (P2)
	14 (P3)
15	13 (P2)
	15 (P3)
16	1 (P2)
	16 (P3)
17	17 (P3)
18	15 (P2)
	18 (P3)
19	19 (P3)
20	25 (P2)
	20 (P3)
21	6, 9 (P2)
	21 (P3)
22	22 (P3)
23	12 (P2)
	23 (P3)
24	20, 22 (P2)
	24 (P3)
25	16 (P2)
	25 (P3)
26	24 (P2)
	26 (P3)

4.8

Compatibility of Emergency when Attaching a Motorola Solutions Branded SB9600 Siren

When and where to use: When using emergency footswitch or pushbutton with siren/PA configuration, REMOVE pin 8 (emergency) from the siren connector of the HKN4363_ siren cable as follows:

Figure 116: Field adjustment for Emergency Operation with Siren Accessory

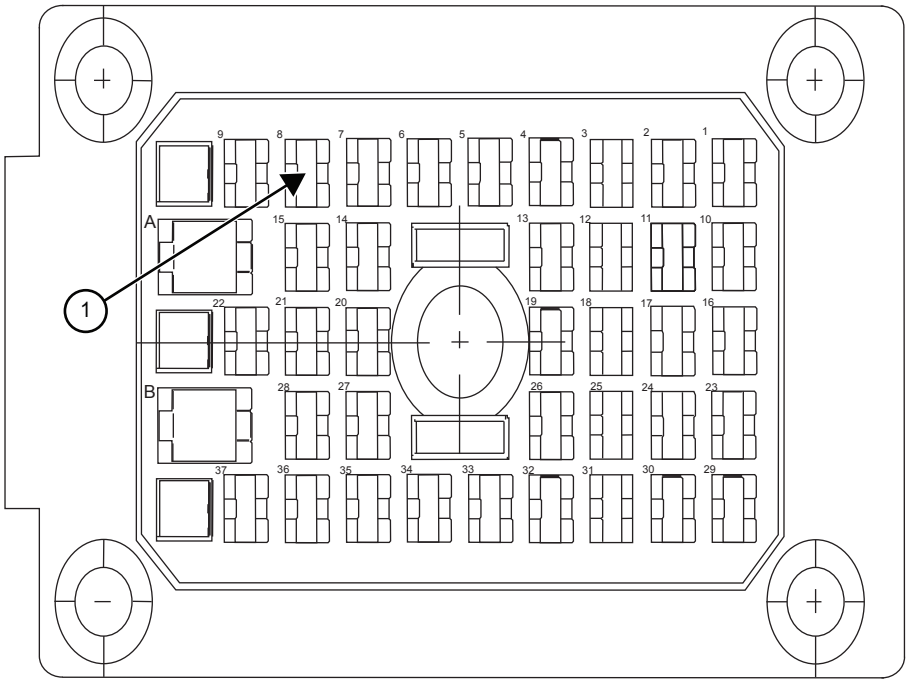


1	Siren Cable

Procedure:

1. Remove the knob from the siren/PA cable connector.
2. Remove all four screws from the connector in the siren/PA cable.
3. Open the connector cap and locate pin 8.
4. Using the contact removal tool (6684690C02), remove pin 8 from the connector.
5. Put the connector cap in place and proceed to reinstall the four screws and the knob.

Figure 117: Location for Pin 8



1	Pin 8

Chapter 5

Motorcycle Radio Installation (Mid Power)

This chapter covers the motorcycle radio installation. .

IMPORTANT: The motorcycle radio installation (from section 5.1–5.7) is NOT AVAILABLE at this time.

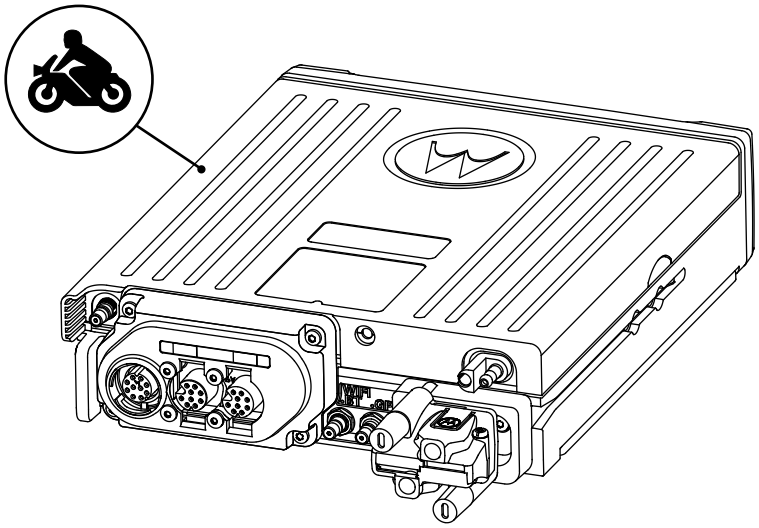
5.1 Motorcycle Radio Description

The motorcycle model includes all the same components in the standard radio.

The following paragraphs describe the unique items provided with the motorcycle models.

A small label is included with the motorcycle radio, which can be placed on the radio to identify it as a motorcycle radio. The label should be placed on a flat and protected area to avoid damage during handling.

Figure 118: Identification of a Motorcycle Radio by Using a Label



5.1.1 Transceiver Enclosure

The transceiver is mounted in the weather-resistant enclosure that consists of a bottom housing and a hinged top cover.

The top cover has a locking latch that requires a key to open. The enclosure is mounted above the rear motorcycle wheel, oriented so that the lock is forward and the hinged cover opens toward the rear of the motorcycle. The bottom housing has a grommeted hole for cable entry and weep holes to permit water drainage.

The enclosure is mounted on the motorcycle with a universal mounting plate and shock and vibration isolators. A large, braided ground-strap (installed between the mounting plate bolts and the motorcycle frame) grounds the transceiver.

5.1.2
Control/Display Unit

All radio functions, except push-to-talk (PTT), are activated from the weather-resistant control head.

The control head and the external speaker are mounted for easy access near the center of the handlebars. The control head is positioned for unobstructed viewing, and it may be tilted on the horizontal axis for ease of viewing. The microphone cable port on the front of the control head is plugged and is not used.

5.1.3
Control Head Cable

The control-head cable connects the control head to the transceiver.

The cable is routed along the motorcycle frame and has weather-resistant connections at both ends. Excess cable is coiled under the transceiver inside the weather-resistant enclosure.

Each end of the cable is strain-relieved with jackscrews at the control head and the transceiver.
The cable is shielded to reduce the effects of radio frequency interference and ignition sense noise.

5.1.4
Microphone

A weather-resistant, palm microphone, and coiled cord plug into a pigtail connector on the control cable.

The microphone attaches to a hang-up bracket located within easy reach of the motorcycle rider. The coiled cord is long enough to be operated by someone standing next to the motorcycle, yet short enough to not interfere with the motorcycle steering or operation.

5.1.5
External Speaker

A 3.2-Ohm, 10-watt-rated-audio-power, external speaker is mounted on the front of the motorcycle.

The speaker cable is routed along the motorcycle frame to the transceiver rear accessory connector. A sealed, weather-resistant, speaker-muting (toggle) switch is mounted on top of the speaker.

The external speaker connects to the rear accessory connector of the transceiver.

5.1.6
Headset Capability

The motorcycle radio is compatible with headset accessories that would provide hands-free operation of the radio.

Motorola Solutions does not manufacture headset equipment, but provides the interconnection for headset equipment with the motorcycle radio. Aftermarket headset equipment is available through Motorola Solutions (see Replacement Parts Ordering on page 147).

CAUTION: To avoid loud audio, refer to the CPS help menu for audio settings if the Motorola Solutions mobile radio is used with any motorcycle helmet headset.

5.1.7
Antenna

The antennas are mounted on top of the transceiver weather-resistant enclosure.
The enclosure metal lining acts as the antenna ground plane.

5.1.8
Ignition Sense (ACC) Wire

The ignition sense wire connects to the motorcycle fuse box and is routed along the motorcycle frame to the transceiver rear accessory connector.

The radio is wired so that transmission is inhibited if the motorcycle ignition sense switch is off. If the PTT switch is pressed with the ignition sense off, a low-frequency tone sounds. The receiver is controlled by the control head on/off switch.

5.2
Installation Overview

All mobile radios are tested and inspected before shipment. It is suggested that the transmitter frequency, deviation, and power output be checked at the time of installation.

It is the license holder's responsibility to ensure that the operating parameters of his station comply with applicable laws governing radio communications equipment. For tests and alignment procedures, see Related Publications on page 16.

Generally, the installation of the motorcycle radio takes place in the following parts:

- Mounting the universal mounting plate and related hardware at the rear of the motorcycle.
- Mounting the control head, speaker, microphone, and related hardware forward on the motorcycle.
- Routing the power cable, control-head cable, speaker cable, and ignition sense cable to the weather-resistant enclosure.
- Mounting the weather-resistant enclosure and radio chassis, and connecting the cables.
- Mounting the antennas to the weather-resistant enclosure.

A universal mounting plate is mounted to the rear carrier, or the rear frame of the motorcycle. The mounting procedures for the universal mounting plate vary from motorcycle to motorcycle.

The procedures given in this manual for installing the mounting plate may not specifically apply, but are provided for guidance.

The control head, speaker, and microphone are mounted forward on the motorcycle, on or near the steering column. There are several possible mounting configurations, which use a combination of Motorola Solutions and customer-built brackets. These configurations are outlined in this manual. The customer-built brackets are necessary to mount the Motorola Solutions equipment to the particular motorcycle being used. Suggestions for customer-built brackets are given in this manual.

The power cable, control-head cable, speaker cable, and ignition sense cable are routed to the weather-resistant position.

The enclosure and the radio chassis are then mounted. Special care is required when connecting cables to the radio equipment within the enclosure.

5.2.1
Important Installation Hints

Consider the following when mounting the radio components:

- Excess lengths of control-head, power, ignition sense, and speaker cables must be routed in the enclosure as shown in Figure 136: Installing Cables on page 131.
- All components must be mounted securely in order to withstand the constant and sometimes severe vibration experienced on a motorcycle.
- No cantilever action, which could cause severe vibration, should be generated in the mounting hardware.

- The control head and microphone must be placed for ease of accessibility by the motorcycle operator.
- Forward components (control head, microphone, and speaker) should not interfere with visual or physical access to controls and instruments.
- Forward components should not interfere with the handling of the motorcycle.
- Cabling between the control head and the radio chassis should be run to minimize interference with operator movements.
- The weather-resistant enclosure should be placed to avoid any interference with the motorcycle operator.
- Electrical continuity must be present through the enclosure shock mounts to the motorcycle frame for proper electrical and RF grounding.
- The antenna is designed for mounting on the top of the weather-resistant enclosure and an adequate metal ground plane.
- Only the supplied microphone mounting clip should be used to ensure secure mounting of the microphone. This clip has a very strong spring to ensure positive retention of the microphone over rough terrain. Also, there must be electrical continuity from this clip to the motorcycle frame for DC grounding.
- Direct access to the microphone should be provided from both sides of the motorcycle.
- Sufficient slack in the microphone coiled cord should be allowed so as not to impede steering.
- Mounting hardware must be stainless steel to prevent corrosion.
- If an extra length of cable is used to extend the microphone, ensure that the added capacitance does not interfere with the operation of the radio.
- A suitable covering should be applied to the DB-9 receptacle when the water resistant microphone (HMN1079) is not connected.

5.2.2
Parts Identification

The following installation procedures refer to Figure 119: Universal Mounting Plate Installation (Part of Radio Enclosure Kit) on page 111 through Figure 137: Installing the Transceiver on page 133. Detailed descriptions of the mounting hardware used in each procedure are provided in parts lists section of the *APX Mobile Basic Service Manual*. See Related Publications on page 16. The parts that are supplied by Motorola Solutions are contained in one of the following kits:

- Motorcycle Weather-Resistant Microphone
- Motorcycle Weather-Resistant Speaker with Mute Switch
- Motorcycle Hardware Kit SECURENET or Motorcycle Hardware Kit
- Motorcycle Power Cable Kit
- Motorcycle Mounting Kit
- Weather-Resistant Enclosure
- Antenna

5.2.3
Installing Procedures

Prerequisites:

Before starting the installation, familiarize yourself with the mounting hardware (see Figure 119: Universal Mounting Plate Installation (Part of Radio Enclosure Kit) on page 111 through Figure 137: Installing the Transceiver on page 133). Perform the installation procedures in the order that follows.

Procedure:

1. Install the universal mounting plate on the motorcycle.
2. Install the control head and speaker.
3. Install the microphone hang-up clip.
4. Install antenna base and cable onto enclosure.
5. Install the cables.
6. Install the weather-resistant enclosure on the universal mounting plate.
7. Route the cables inside the weather-resistant enclosure.
8. Install the transceiver in the weather-resistant enclosure.
9. Install the antennas on the enclosure.

5.3 Universal Mounting Plate

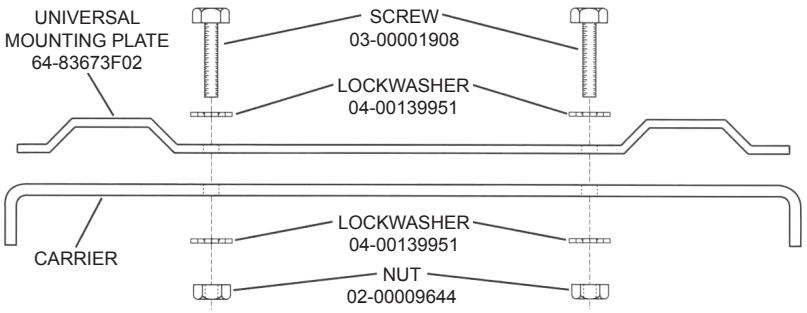
The universal mounting plate, supplied with the motorcycle radio, must be mounted on the motorcycle first. It provides the base for the weather-resistant enclosure to be mounted.

The method used for mounting the plate depends on the make and model of the motorcycle and whether the plate is mounted to a carrier or to the motorcycle chassis. After the plate has been securely mounted to the motorcycle, mounting the weather-resistant enclosure onto the plate is straightforward.

Figure 119: Universal Mounting Plate Installation (Part of Radio Enclosure Kit) on page 111 illustrates the universal mounting plate mounted to a motorcycle carrier. Since there are so many makes and models of motorcycles and motorcycle carriers, it is impossible to give specific step-by-step instructions for mounting the universal mounting plate. However, noting the following considerations aids in the installation procedure.

- A minimum of holes are pre-drilled into this plate as supplied. Mounting holes must be drilled as required for the particular motorcycle on which the plate is being mounted.
- The universal mounting plate should be mounted on the motorcycle in such a manner that the later mounting of the weather-resistant enclosure does not interfere with the motorcycle seat back, with any other obstacles, or with the motorcycle operator. The enclosure may be temporarily bolted to the universal mounting plate and the unit positioned on the motorcycle to ensure that the criteria are met.
- To ensure a good grounding path from the universal mounting plate to the motorcycle carrier or frame, stainless steel lock washers must be used with the mounting hardware in two areas to score through the paint on the universal mounting plate and on the carrier or frame. It provides good electrical contact with the underside of the motorcycle carrier or motorcycle frame.

Figure 119: Universal Mounting Plate Installation (Part of Radio Enclosure Kit)



5.3.1
Installing the Universal Mounting Plate

Follow the procedure to mount the universal mounting plate to the motorcycle.

Procedure:

1. Determine the mounting position for the mounting plate.
2. Determine whether stainless steel spacers are required for clearance in mounting the plate.
3. Drill four 9/32-inch holes in the mounting plate and the corresponding motorcycle carrier or chassis for mounting the plate.
4. Attach the universal mounting plate to the motorcycle using four machine screws, eight lock washers, and four nuts. Tighten screws securely. The lock washers must cut through the paint on the plate and motorcycle carrier or frame to ensure a good ground path.

5.4
Speaker and Control Head Installation

NOTE: To disable the internal speaker of the O2 Control Head, see Internal Speaker Disassembly on page 73.

The control head mounting location and configuration is determined by the make and model of the motorcycle.

You can mount the speaker and control head using the following configurations:

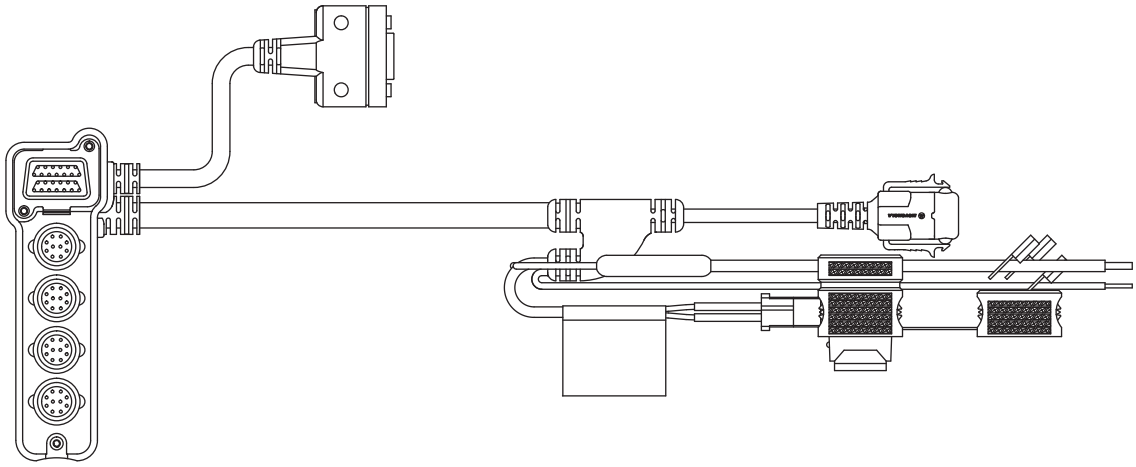
- Mount the speaker and control head together as a unit using the combination of speaker or control-head bracket (see Figure 121: Handlebar Installation with Speaker and Control Head Mounted Together on page 113) supplied by Motorola Solutions.
- Mount the control head by itself using a smaller control-head bracket supplied by Motorola Solutions. In this case, the speaker is mounted elsewhere.

This section outlines installation procedures for each configuration mentioned above.

You can determine the most appropriate mounting configuration for the control head and speaker based on the motorcycle on which the equipment is to be mounted.

CAUTION: When determining its location, position the control head so that it is clearly visible and within easy reach of the motorcycle operator.

Figure 120: Motorcycle Control Head Cabling (3075217A01)

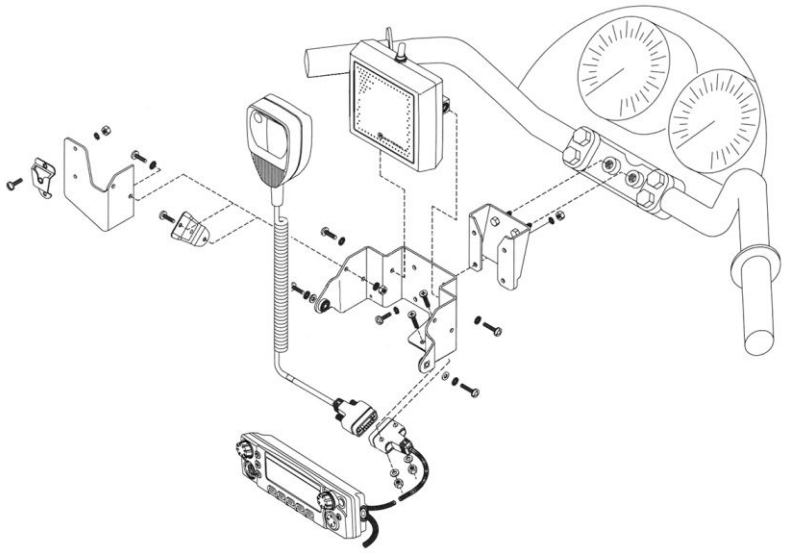


5.4.1

Handlebar Installation with Speaker and Control Head Mounted Together

Figure 121: Handlebar Installation with Speaker and Control Head Mounted Together on page 113 illustrates the combination of speaker/control head bracket. This combination bracket is used only when the control head and speaker are mounted as a unit. Handlebar-mounting bracket which may be required if the combination speaker/control-head bracket cannot be easily mounted to the motorcycle. In this case, the handlebar-mounting bracket is mounted to the motorcycle, and the combination bracket is then mounted to the handlebar-mounting bracket.

Figure 121: Handlebar Installation with Speaker and Control Head Mounted Together



Provision has been made on the combination speaker/control-head bracket for mounting the microphone hang-up clip. If that mounting is desired, the hang-up clip must be attached to the bracket before installing the control head and speaker. See Microphone Hang-Up Clip on page 75 for the hang-up clip procedure.

5.4.1.1

Installing Handlebar with Speaker and Control Head Mounted Together

Follow the procedure to install the speaker and control head.

Procedure:

1. Determine the location to mount the speaker/control head. Consider how the speaker/control-head bracket may be mounted, and whether a handlebar-mounting bracket is needed. Select a location that is not only mechanically convenient, but is located for ease of operation.

   NOTE: The angle at which the handlebar-mounting bracket or the speaker/control-head bracket is mounted to the motorcycle determines the firing angle of the speaker.

2. If the handlebar-mounting bracket is needed, install it first.
3. Mount the speaker/control-head bracket, either directly to the motorcycle, or, if used, to the handlebar-mounting bracket, using four stainless-steel machine screws, lock washers, and nuts.

4. Mount the 9-pin D-connector end of the motorcycle control-head cable to the speaker/control head bracket, using two machine screws, flat washers, and nuts. (Cable routing directions appear later in this section.)
5. Mount the speaker on the speaker/control-head bracket, using two machine screws and lock washers. Torque these screws to 20 in-lbs.
6. Attach the control-head cable to the control head and tighten the locking screws on the connector. This connection must be made before you mount the control head in the bracket. (Cable routing directions appear later in this section.)
7. Mount the control head to the bracket, using two machine screws, lock washers, and flat washers.
8. Adjust the control head viewing angle by loosening its mounting screws and rotating the control head to the desired angle. Re-tighten the screws to 20 in-lbs torque.

5.4.2
Fuel Tank Console Installation with Speaker and Control Head Mounted Together

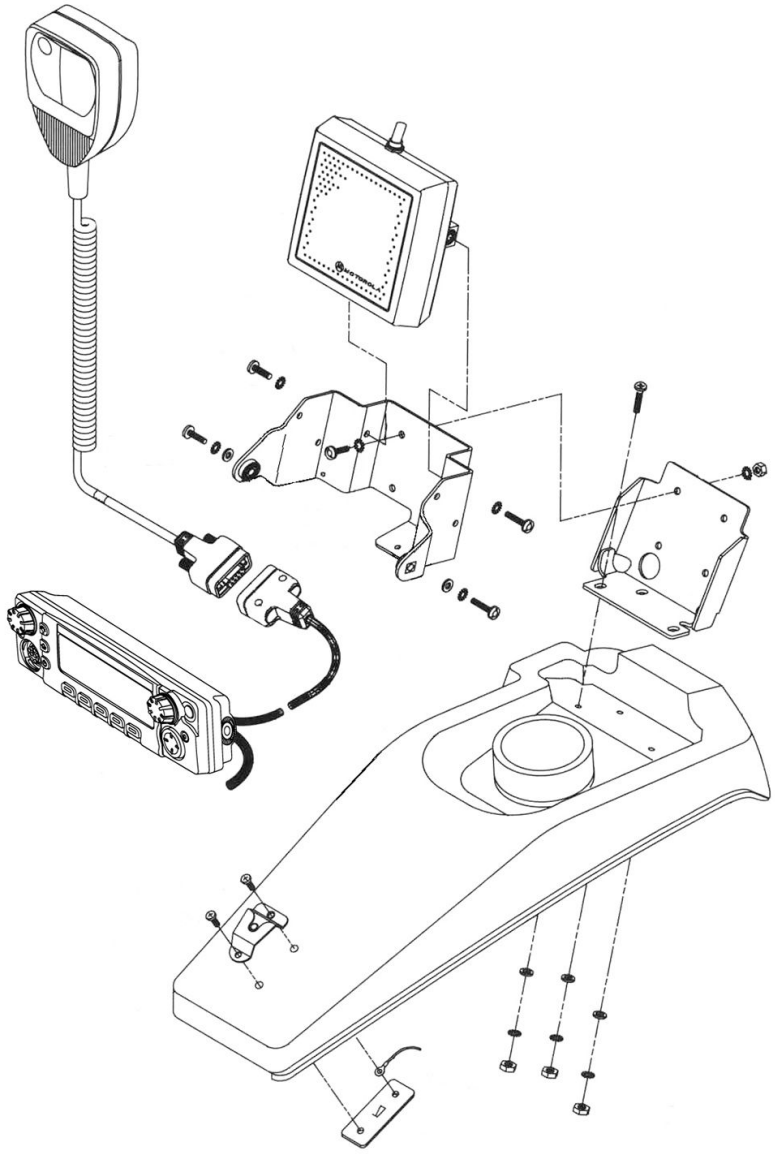
Some motorcycles provide a console for mounting radio equipment. This console is attached to the top of the fuel tank. With the use of a mounting bracket, screws, nuts, and lock washers, the combination speaker/control-head bracket can be mounted to this console. Figure 122: Fuel Tank Console Installation with Speaker and Control Head Mounted Together on page 115 illustrates this type of mounting.

The console attachment screws must be removed, and the console must be lifted slightly from the fuel tank to gain access to attach mounting hardware, and to route cables later.

In this installation, the microphone (mic), mic hang-up bracket, and mic extension bracket interfere with handlebar travel.

Installation using this method is the same as in Installing Handlebar with Speaker and Control Head Mounted Together on page 113.

Figure 122: Fuel Tank Console Installation with Speaker and Control Head Mounted Together



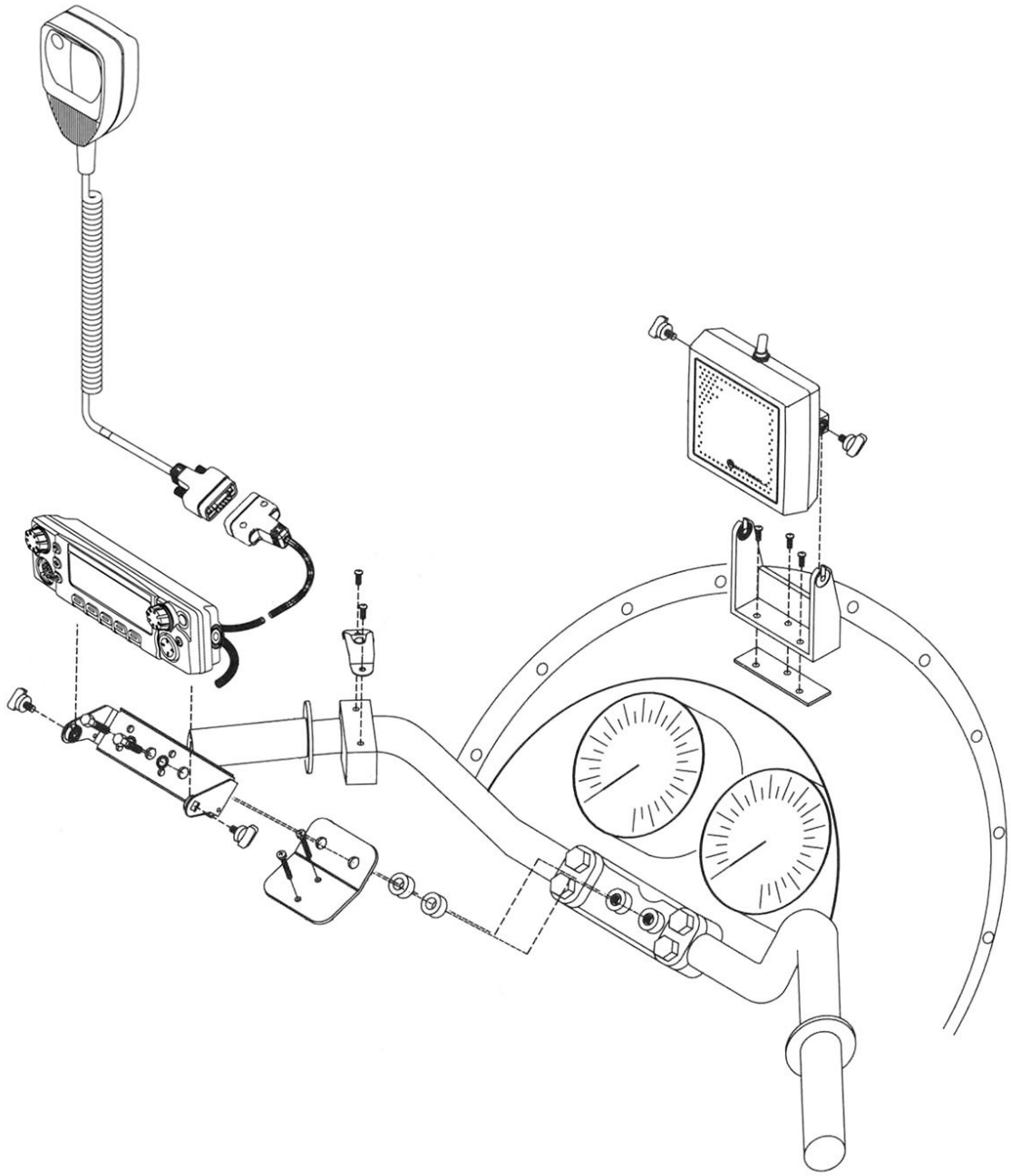
5.4.3

Handlebar Installation with Speaker and Control Head Mounted Separately

It may be necessary to use the smaller control head bracket (part number 0780127N02) and mount the speaker and microphone hang-up clip in another location on the motorcycle.

Temporarily fasten the control-head end of the control-head cable to the control head. Also, fasten the control head to its bracket before installing the control head using the described bracket. Motorola Solutions-supplied spacers and mic-cable bracket are required to mount the control head to the handlebar. This mic-cable bracket has holes to mount the microphone-cable connector.

Figure 123: Handlebar Installation with Speaker and Control Head Mounted Separately



5.4.3.1

Installing Handlebar with Speaker and Control Head Mounted Separately

Follow the procedure when mounting the smaller control-head bracket.

Procedure:

1. Determine the location to mount the control head. Choose a location that is not only mechanically convenient, but is located for ease of operation.

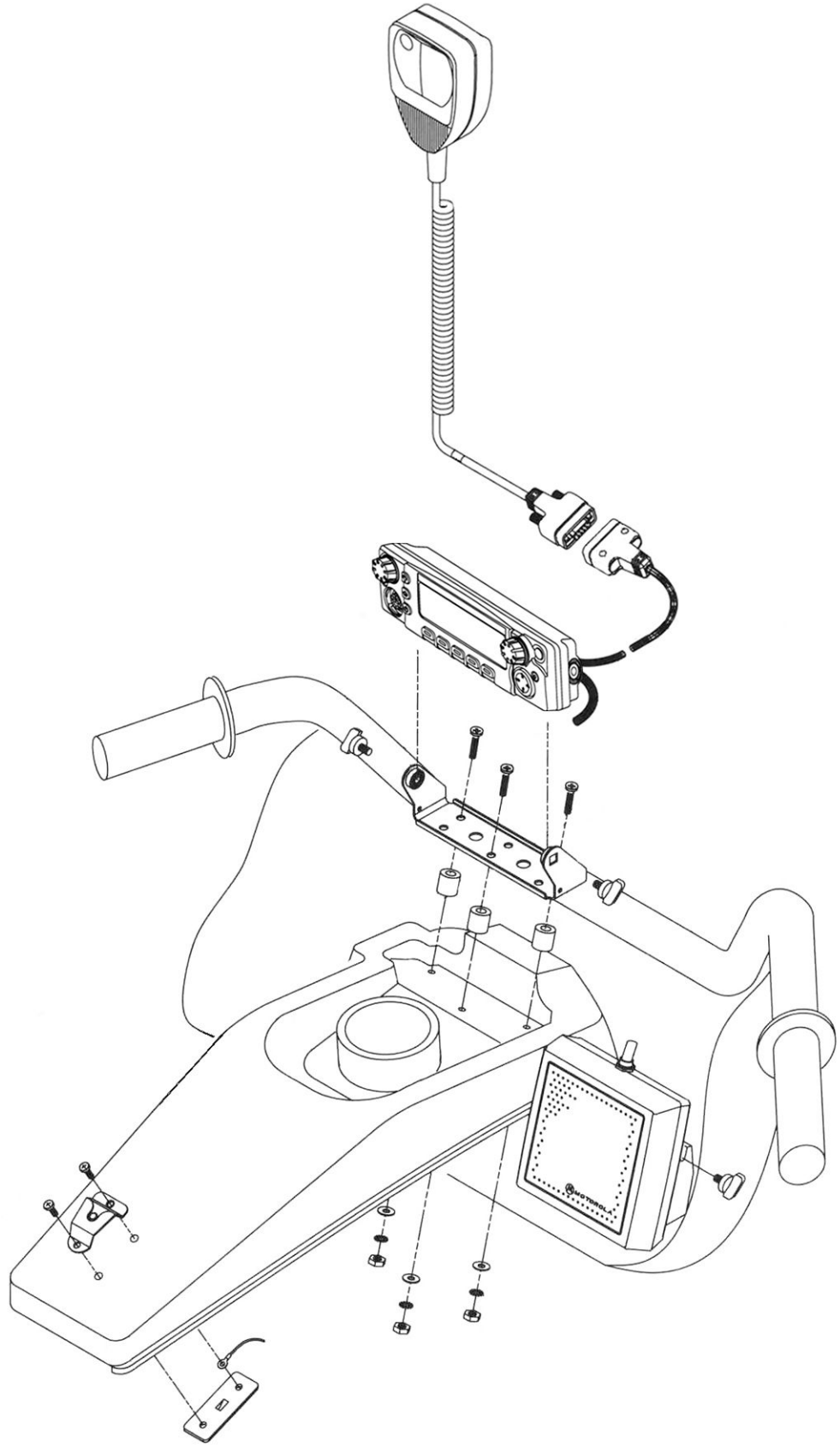
2. Securely mount the Motorola Solutions-supplied spacers, mic-cable bracket, and small control-head bracket to the handlebars.
3. Mount the 9-pin D-connector end of the motorcycle control-head cable to the mic-cable bracket, using two machine screws, flat washers, and nuts. Refer to Cable Routing on page 127 for Cable routing directions.
4. Attach the control-head end of the cable to the control head and tighten the locking screws on the connector.
5. Mount the control head to the small control-head bracket, at the proper viewing angle, using two wing screws and tighten firmly.

5.4.4
Fuel Tank Console Installation with Speaker and Control Head Mounted Separately

The control head may be mounted to the fuel tank console using the smaller control-head bracket and spacers/hardware.

In this configuration, the microphone cable connector may be attached directly to the console, eliminating the need for a custom bracket.

Figure 124: Fuel Tank Console Installation with Speaker and Control Head Mounted Separately



Installation is the same as detailed in Fuel Tank Console Installation with Speaker and Control Head Mounted Together on page 114 and Installing Handlebar with Speaker and Control Head Mounted Separately on page 116.

5.5 Installing the Speaker

Follow the procedure when the speaker is mounted separately from the control head.

When and where to use: The speaker bracket supplied with the speaker may be used alone if a suitable location can be found, or if necessary, a customer-supplied bracket may be fabricated for mounting the speaker.

NOTE: To disable the internal speaker of the O2 Control Head, please refer to Internal Speaker Disassembly on page 73.

Procedure:

1. Determine the location to mount the speaker and whether there is a requirement for a customer-supplied bracket.
2. Fabricate a bracket if required. Use the Motorola Solutions-supplied speaker bracket as a template for drilling mounting holes. Drill holes in the fabricated bracket for mounting to the motorcycle.
3. Mount the fabricated bracket to the motorcycle chassis.
4. Mount the Motorola Solutions-supplied bracket to the fabricated bracket using two machine screws, flat washers, lock washers, and nuts.
5. Mount the speaker to the speaker bracket using two wing screws. Refer to Cable Routing on page 127 for Cable routing directions.

5.6 Microphone Hang-Up Clip Installation

Install the hang-up clip either on the supplied microphone extension bracket or on the side of the speaker/control head bracket. Both methods are shown in Figure 121: Handlebar Installation with Speaker and Control Head Mounted Together on page 113. Determine the mounting location and install as described in the following paragraphs.

NOTE: Wherever the hang-up clip is mounted, it must be DC grounded for proper operation. After mounting the clip, be sure there is electrical continuity between the clip and the motorcycle chassis.

5.6.1 Extension Bracket Mounting

Follow the procedure to mount the clip facing the operator.

Procedure:

1. Attach the bracket to the speaker/control-head bracket using two machine screws, four lock washers, and two nuts as shown in Figure 121: Handlebar Installation with Speaker and Control Head Mounted Together on page 113.
2. Torque nuts to 20 in-lbs torque.
3. Fasten the hang-up clip to the extension bracket using two machine screws, lock washers, and nuts as shown in Figure 121: Handlebar Installation with Speaker and Control Head Mounted Together on page 113.

4. Torque nuts to 20 in-lbs torque.

5.6.2
Speaker/Control Head Bracket Side Mounting

Follow the procedure for the speaker/control head bracket side mounting.

Procedure:

1. Attach the hang-up clip to the left side of the speaker/control-head bracket using two machine screws, lock washers, and nuts as shown in Figure 121: Handlebar Installation with Speaker and Control Head Mounted Together on page 113.
2. Torque nuts to 20 in-lbs. torque.

5.6.3
Mounting Other Hang-Up Clip

A customer-supplied bracket may be used to mount the microphone hang-up clip in another location.

When and where to use:

You can mount the hang-up clip to any location that does not block controls and indicators, and interfere with motorcycle handling. For alternative microphone hang-up clip mounting methods, see Figure 122: Fuel Tank Console Installation with Speaker and Control Head Mounted Together on page 115, Figure 123: Handlebar Installation with Speaker and Control Head Mounted Separately on page 116, and Figure 124: Fuel Tank Console Installation with Speaker and Control Head Mounted Separately on page 118 .

Procedure:

1. Fabricate a bracket.
2. Secure the bracket to the motorcycle.
3. To secure the hang-up clip to the customer-supplied bracket, screw the two machine screws, lock washers, and nuts. Ensure that the microphone clip is DC grounded to the motorcycle chassis.

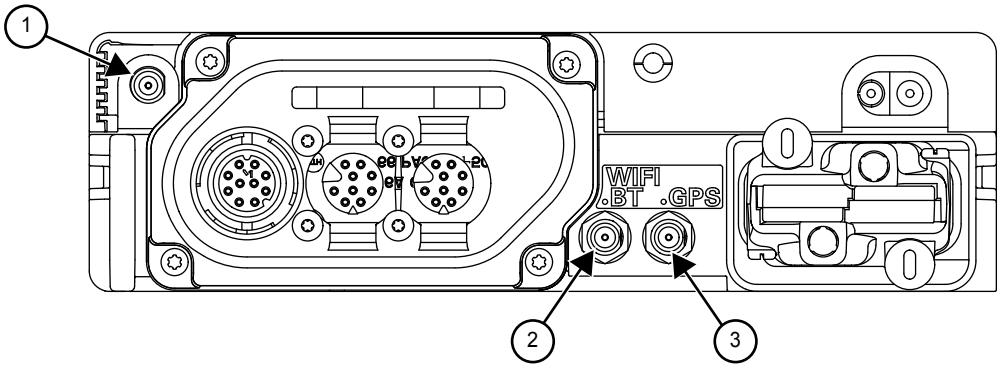
5.7
Installing Antenna Base, Cables, and Multiplexer

Prerequisites:

The GPS antenna assembly must be done after the removal of the metal liner but before reinstalling the radio liner.

NOTE: Antenna hole placement and cable routing in 700/800, VHF, and UHF antenna manuals are not applicable for the APX Series.

Figure 125: Antenna Band Identification

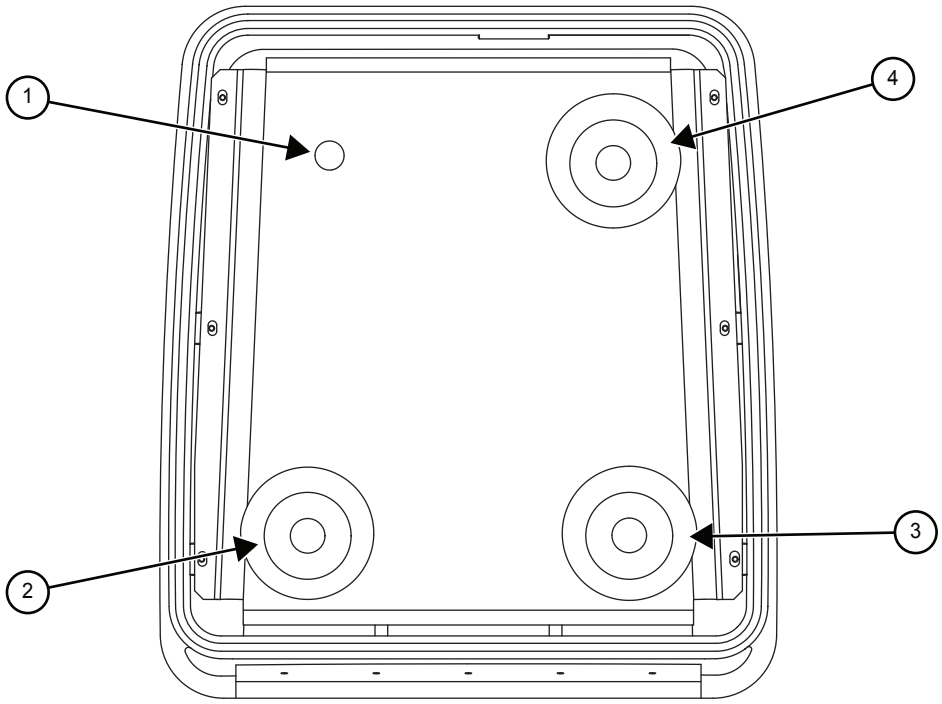


1	LMR all-band Port
2	Wi-Fi Antenna Port
3	GPS Antenna Port

Procedure:

1. Open the top cover of the weather-resistant enclosure.
2. Uninstall the metal liner that is shipped attached to the weather-resistant enclosure. This liner has one depressed area at the top of the enclosure liner just toward the rear of the enclosure. This metal liner is not used with APX Series products.
3. Place the metal liner with two round, depressed areas toward the enclosure hinge and 1-inch hole near the front of the housing, inside the top cover, and align the six slots in the metal liner with the screw holes in the top housing.
4. The metal liner of the enclosure top cover acts as a ground plane for the antenna.
5. Locate the two round, depressed areas about 3 inches in diameter in the metal liner near the enclosure hinge. Referring to Figure 126: Antenna Port Locations on page 122, these areas are either VHF or UHF depending on the antenna port locations. For the GPS antenna, use the 1-inch hole near the front of the housing near the lock.

Figure 126: Antenna Port Locations



1	GPS/Wi-Fi
2	700/800 Antenna
3	UHF Antenna
4	VHF Antenna

6. These holes in the metal liner is used as a template to mark the position of the holes to be drilled at the top cover.
7. Remove the metal liner from the top cover.
8. For LMR all-band antenna, use the Motorola Solutions RPX-4378A Hole-Cutting Saw or equivalent, and carefully drill a 3/4-inch hole at the marked location from the inside the cover until the saw bottoms out. For the GPS/WiFi, carefully drill a 1 1/16-inch hole at the marked location from the inside the cover until the saw bottoms out. The saw should clean a neat circle to assure good contact between the antenna and the housing.

   IMPORTANT: For proper seating of the antennas, deburr and scrape any foreign matter from both sides of the hole, being careful not to mar the finish of the shell.
9. Clean the mounting surface around the hole to remove dirt and wax.
10. Refer to the *Motorcycle GPS Instruction Manual* for further installation instruction for the GPS. GPS must be mounted before the metal liner is installed.
11. Reinstall the APX metal liner with the cable clamps provided in the weather-resistant housing.
12. To attach the 700/800, VHF, or UHF antenna base, refer to the *Antenna Installation Manual*.

    IMPORTANT: Antenna Placement and Cable Routing in the Antenna Installation Manual is not applicable for the APX series.
13. Route the coaxial cable for the 700/800, VHF, or UHF antenna through the cable clamps.

14. Route the coaxial cable for the 700/800, VHF, or UHF antenna through the cable clamps. Refer to Figure 128: Routing the VHF Antenna Cable on page 124 for VHF hole, Figure 129: Routing the 700/800 Antenna Cable on page 124 for 700/800 hole, and Figure 130: Routing the UHF Antenna Cable on page 125 for UHF hole.

CAUTION: Be sure to observe the correct routing of the antenna cable. Failure to do so can damage the cable.

Figure 127: Routing the GPS/Wi-Fi Cable

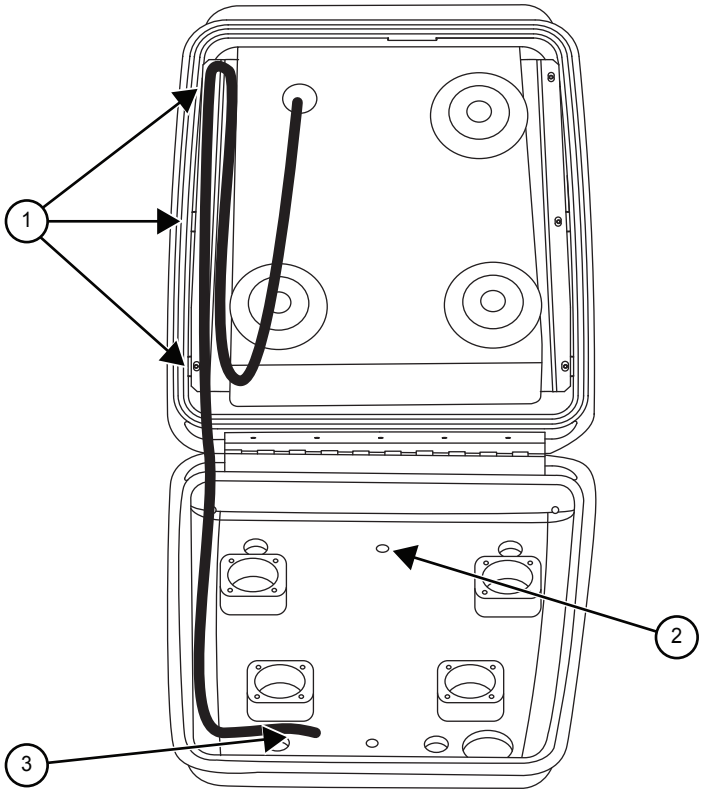


Figure 128: Routing the VHF Antenna Cable

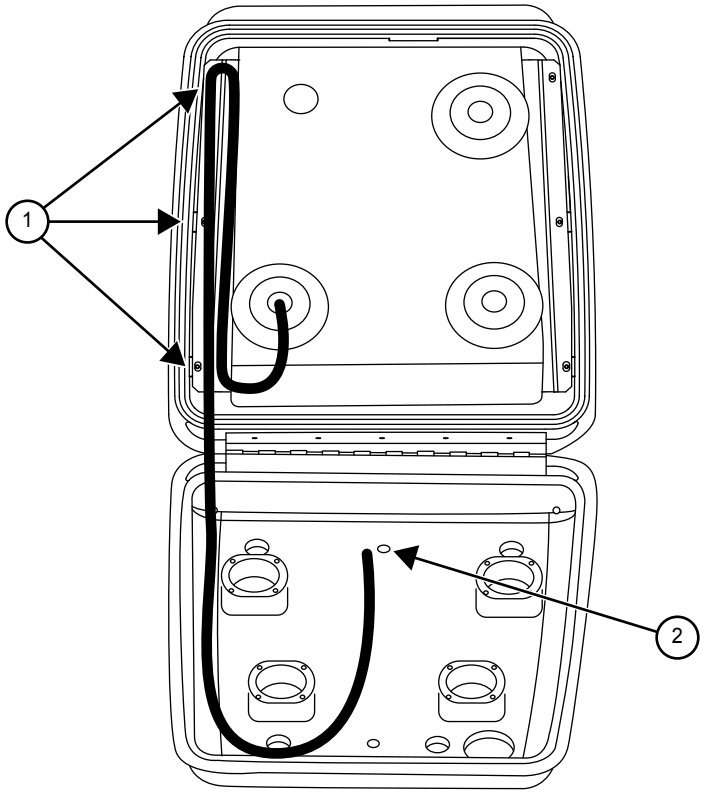


Figure 129: Routing the 700/800 Antenna Cable

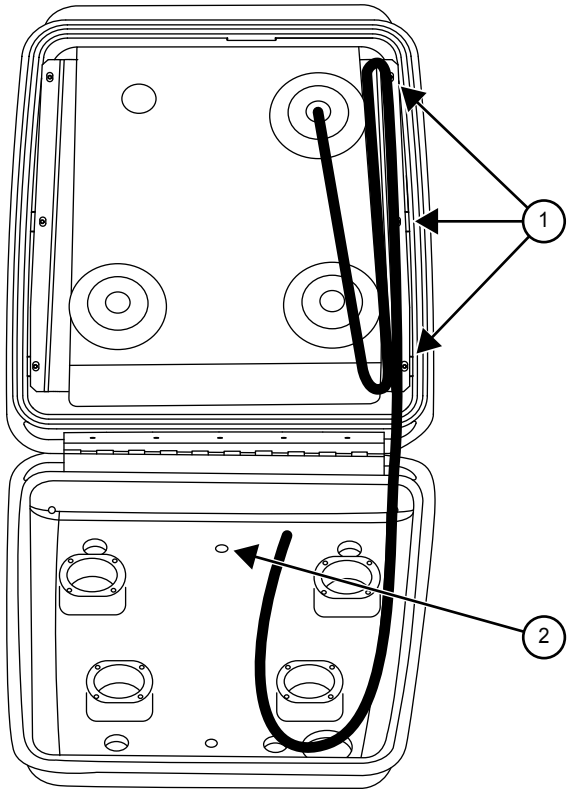


Figure 130: Routing the UHF Antenna Cable

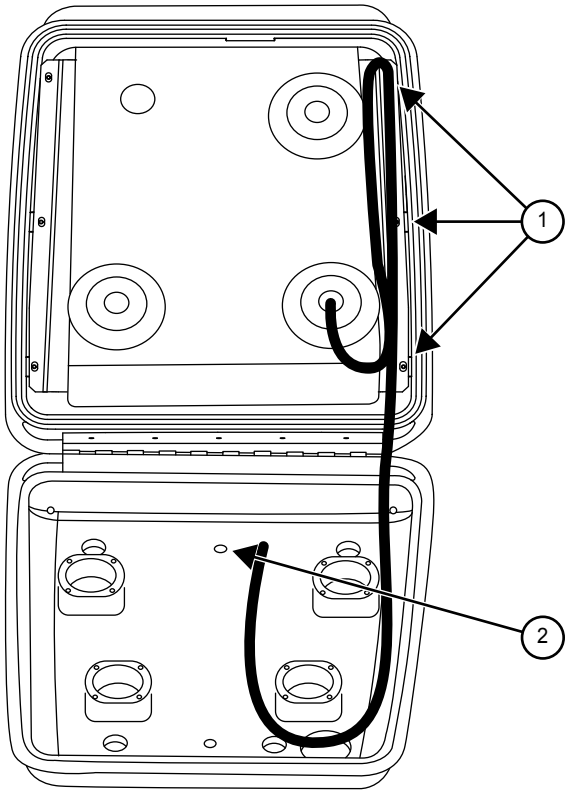


Figure 131: Multiplexer and Trunnion Mounting

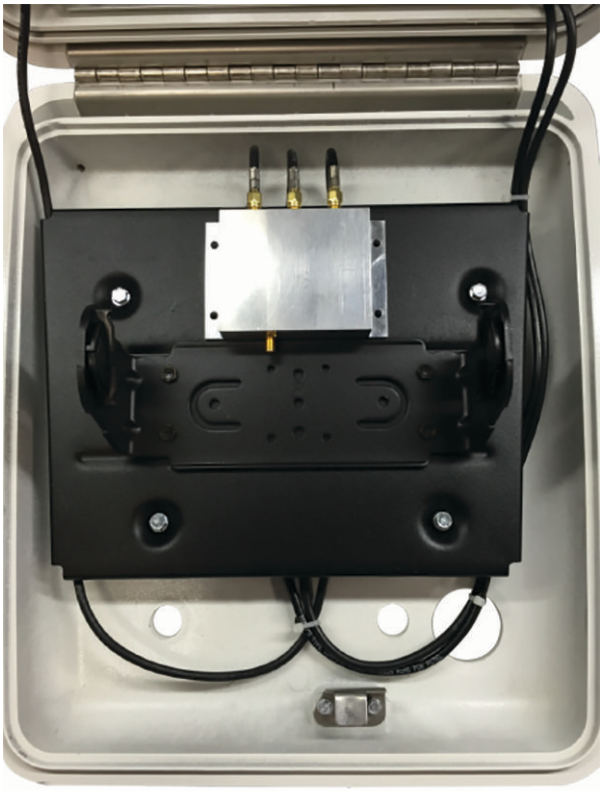


Figure 132: Cable Routing

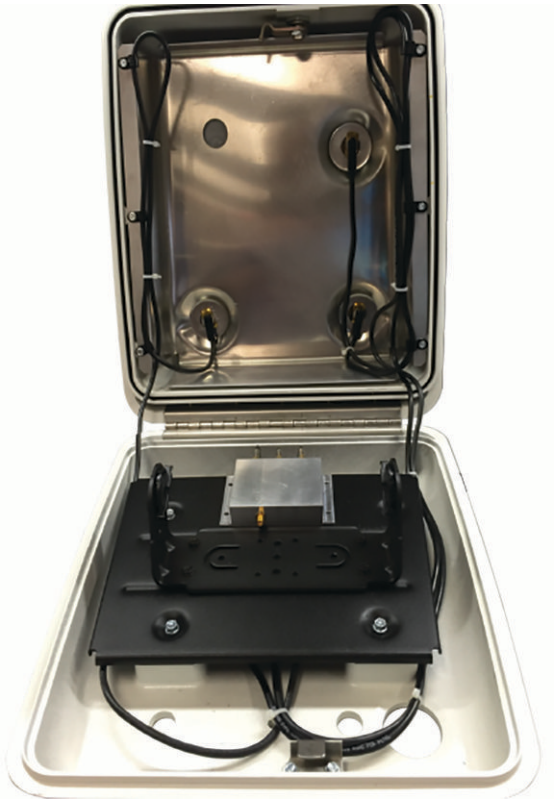
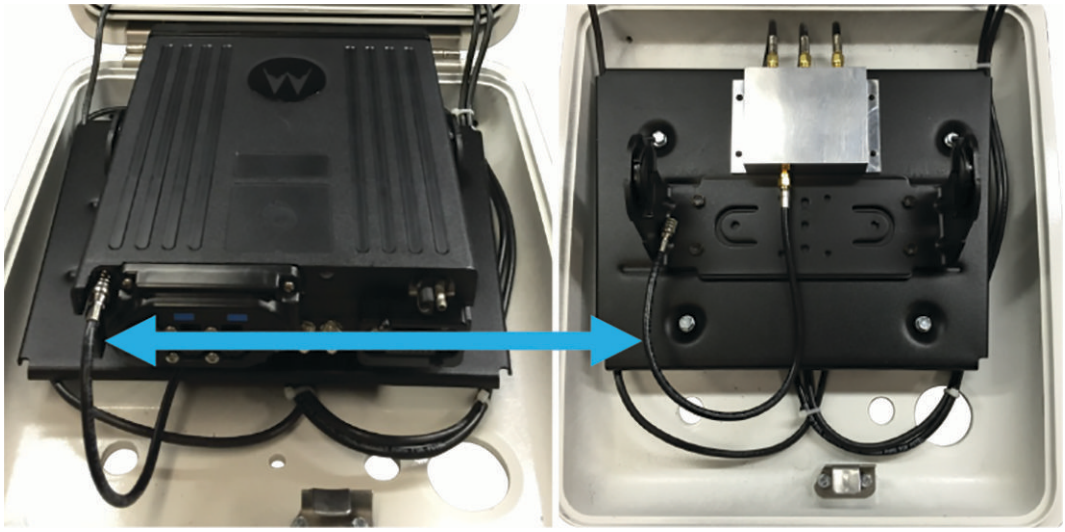


Figure 133: Cable from Radio to Multiplexer



NOTE: Radio has to be mounted with the TIB facing the front of the enclosure

15. After routing cable, allow enough of the cable to reach the radio antenna connector and cut off any excess length of the cable.
16. To install the connector, refer to the *Antenna Installation Manual*.

5.8 Installing the Antenna

Procedure:

Connect the appropriate antenna connectors to the antenna receptacles on the radio. Tighten the coupling until fully engaged.

IMPORTANT: Antenna Placement and Cable Routing as described inside the Antenna Installation Manual is not applicable for the APX radio series.

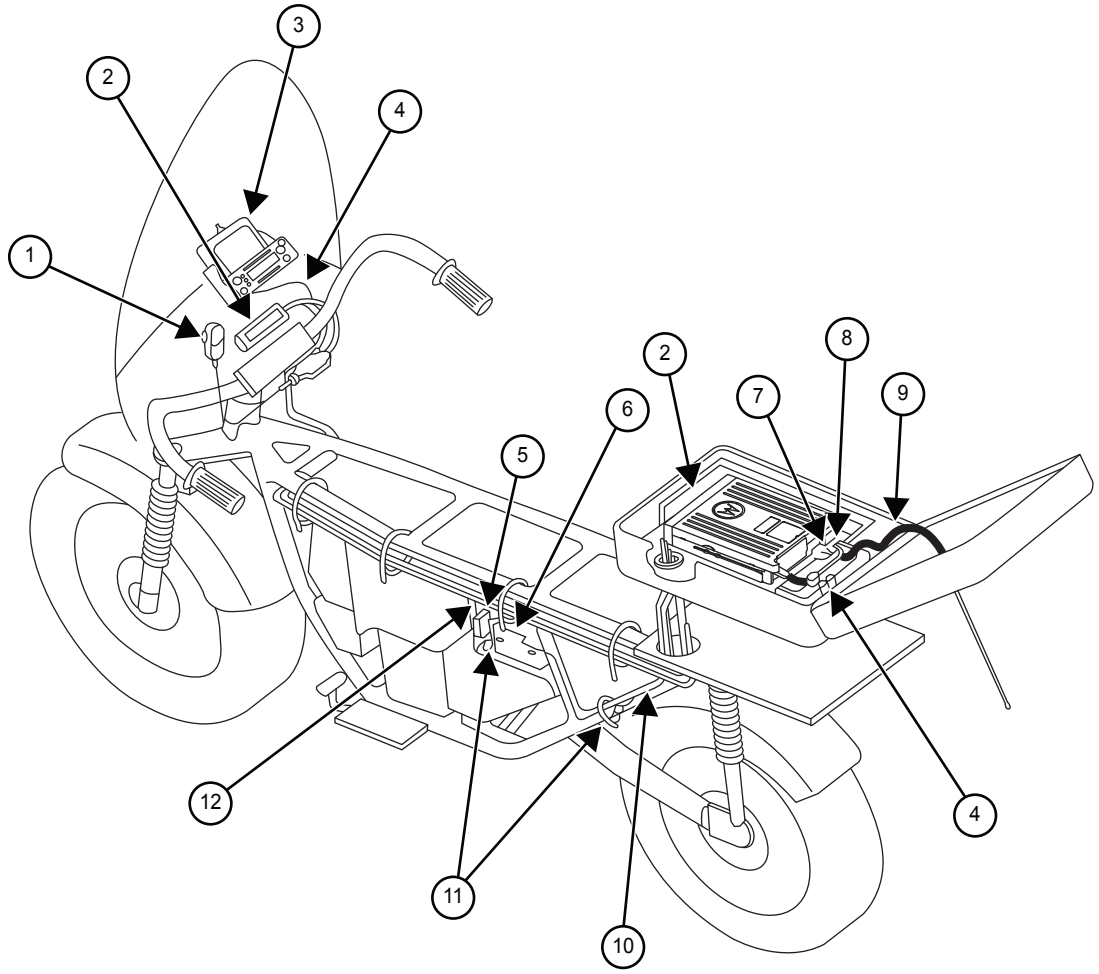
5.9 Cable Routing

Five cables must be installed to interconnect the components of the radio system as shown in the following figure. The antenna cable is routed away from the other cables inside the enclosure hinged cover (see Installing Antenna Base, Cables, and Multiplexer on page 120). The four remaining cables, routed along the motorcycle frame, are described in the following paragraphs.

NOTE: Antenna Hole Placement and Cable Routing information in the *Antenna Installation Manual* is not applicable to the APX series.

Removal of the fuel tank and seat from the motorcycle facilitates routing the cables along the frame. Motorcycles with consoles attached to fuel tanks require routing cables between console and fuel tank. In this case the tank is not removed.

Figure 134: Cable Routing



No.	Description
1	Microphone
2	Control Head Cable
3	Speaker / Control Head
4	Speaker Cable
5	Fuse Block
6	Battery
7	Power Cable
8	Accessory Cable
9	Antenna Cable
10	Fused Power Cable
11	Chassis Ground
12	Ignition Cable

Speaker Cable
Runs from the speaker to the accessory-cable connector inside the weather-resistant enclosure.

Control Cable
Runs from the rear of the control head to the front of the transceiver inside the enclosure.

Ignition Sense (Red) Wire Portion of Accessory Cable
Runs from the ignition sense fuse terminal of the fuse box to the rear area inside the enclosure. The lug for attaching the ignition sense wire is contained on the accessory cable.

Power Cable
The red, unterminated end runs from the positive terminal of the battery to the power connector that plugs in the rear of the transceiver. Lugs for attaching the red and black leads are contained in the motorcycle power-cable kit. The black, unterminated end runs from a suitable motorcycle chassis ground to the power connector. DO NOT connect the black lead directly to the negative battery post.

You may route the cables in any order. As you route each cable, temporarily fasten it at both ends. When all cables have been run, permanently fasten the cables with appropriate cable tie wraps. Observe the followings during routing and hook-up:

1. Route the cables so that none interfere with motorcycle operation.
2. Fasten the cables with supplied nylon tie wraps. The wraps should be firmly installed at frequent intervals along the cable length in such a manner that motorcycle vibration will not cause metal fatigue and subsequent breakage of the cable wires.
3. Position cables away from parts of the motorcycle that become hot.

Bundle excess cable length inside the weather-resistant enclosure as discussed in Transceiver, Cabling, and Multiplexer Installation on page 130.

The fifth cable is the microphone with coiled cord. Plug the 9-pin D-connector end of the coiled cord into its mating connector, which is attached near the control head discussed in an earlier paragraph. Tighten the coiled-cord-retention screws. Insert the S-hook strain relief (terminated to the coiled cord) into the hole in the mounting bracket. Slide the microphone into the microphone hang-up bracket.

5.10
Installing the Weather-Resistant Enclosure

Procedure:

1. Remove the radio-mounting plate by removing four screws, lock washers, and flat washers.
2. The weather-resistant enclosure is mounted to the universal mounting plate using shock mounts. Assemble the shock-mount components exactly as shown in Figure 135: Weather-Resistant Enclosure Installation on page 130. Be sure to install ground straps between the shock-mount and the transceiver trunnion mount, and install one 7-1/2-inch ground strap between the right rear mount and the enclosure lid's antenna ground plane 0 (shown in Figure 135: Weather-Resistant Enclosure Installation on page 130 and in Figure 137: Installing the Transceiver on page 133).
3. The order of assembly is important to ensure proper shock mount operation. All components are supplied with the mounting kit. The five 7-1/2-inch straps are used on the rear and front shock mounts–four from shock mount to trunnion, and one from the shock mount to the lid's antenna ground plane.

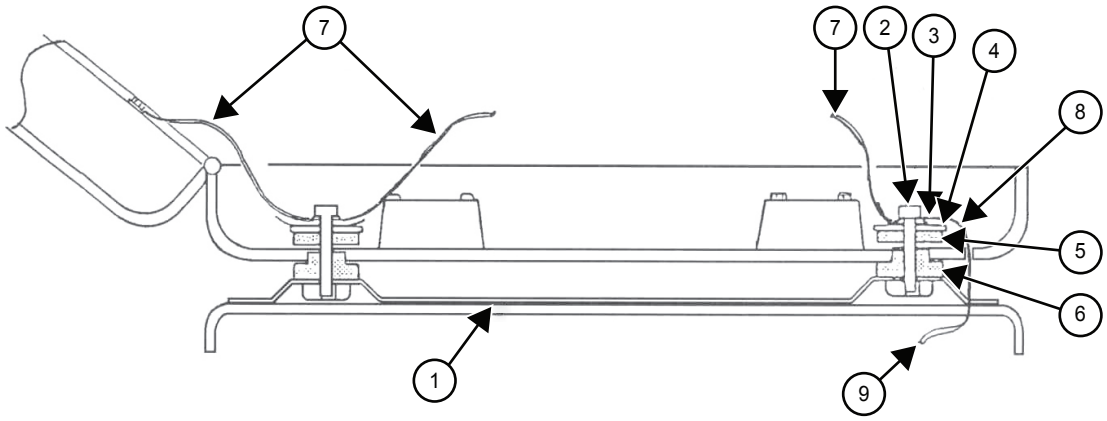
   NOTE: Grounding through the power-supply cable is NOT sufficient. Whether the radio transceiver is mounted to a carrier or the chassis itself, the transceiver MUST be properly grounded to the motorcycle chassis. The ground strap supplied with the installation kit may have to be used to ensure a good RF ground path from the radio transceiver to the motorcycle chassis.

4. Install the 3-foot ground strap on one of the front shock mounts. Route it through the cable-routing hole and connect the other end to the motorcycle frame (see Figure 135: Weather-Resistant Enclosure Installation on page 130).

   WARNING: DO NOT connect the ground strap directly to the negative battery post.

5. The diagram of the shock mount is shown loosely assembled. After the hex screws are tightened, the rubber washers are compressed to fasten the weather-resistant enclosure securely to the universal mounting plate.
6. Figure 137: Installing the Transceiver on page 133 is an exploded view of the enclosure; it shows details that will help to understand how the enclosure is mounted. After the enclosure is completely mounted, check for proper ground connection–continuity between the antenna ground plane and the motorcycle frame.

Figure 135: Weather-Resistant Enclosure Installation



No.	Description
1	Universal Mounting Plate
2	Machine Screw
3	Lockwasher
4	Flat Washer
5	Flat Rubber Washer
6	Shouldered Rubber Washer
7	7-1/2-inch Ground Strap
8	Ground Strap
9	To Motorcycle Chassis Ground

5.11 Transceiver, Cabling, and Multiplexer Installation

After the weather-resistant enclosure has been installed, the radio chassis (transceiver) is installed in the enclosure and then appropriate cables are connected.

Before the transceiver can be installed, the cabling must be properly positioned in the enclosure.

5.11.1

Installing Cabling in the Enclosure

Follow the procedure to position the cabling in the weather-resistant enclosure.

Procedure:

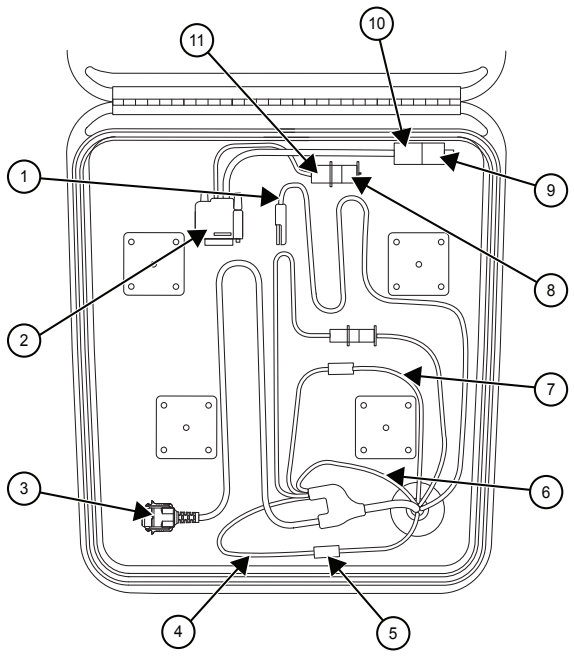
1. Run the speaker, power, control-head, and ignition sense cables into the enclosure.
2. Lay the excess cable length between the radio mounting bosses in an S configuration as shown in Figure 136: Installing Cables on page 131. Do not coil any excess cable. Use the supplied tie wraps to bundle cable as shown.

   NOTE: If the extra cable length is not sufficient to match the illustrated cable routing, then match the illustration as closely as possible.
3. Connect the speaker cable to the accessory cable connector.

   NOTE: The accessory-cable emergency connector is shipped with a shorting plug installed. The headset connector is also shipped with a shorting plug installed. If an emergency switch and/or headset is not used, the plugs must remain in. If an emergency switch and/or headset is used, remove the shorting plug and discard.
4. Install the mounting plate in position on top of the cables installed above. Take care not to damage or pinch the cables when securing the mounting plate in position.

   NOTE: The control-head cable plug should be at the forward end of the enclosure, and the power-cable, speaker-cable, and accessory-cable plugs should be at the rear of the enclosure.

Figure 136: Installing Cables



No.	Description
1	Transceiver Power Cable
2	Accessory Cable
3	Control Cable (CAN)
4	Control Head Power (Red)

No.	Description
5	Control Head Power Fuse
6	Control Head Ground (Black)
7	Ignition Sense (ACC)
8	Emergency Cable Shorting Plug
9	Headset Sporting Plug
10	Accessory Cable Headset Connector
11	Accessory Cable Emergency and External Alarm Connector

5.11.2

Installing the Transceiver

Prerequisites:

Install the transceiver in the weather-resistant enclosure as follows (see Figure 137: Installing the Transceiver on page 133).

NOTE: For new or existing installations, use only the APX mobile trunnion (kit number: HLN7002_).

Procedure:

1. Install the mounting trunnion and loose ends of the four ground straps to the radio-mounting plate, using four screws, flat washers, and external-tooth lock washers (see Figure 137: Installing the Transceiver on page 133). The ground straps must be sandwiched between the flat washers and lock washers. The lock washer must be against the trunnion. The flat washer must be under the screw head.
2. Attach the transceiver to the mounting trunnion and secure with the two screws provided.
3. Connect the control cable to the front of the transceiver. Ensure the control cable connector screws are tightened.
4. Attach the accessory connector to the transceiver. Plug in the power connector.
5. Install the grommet around the cables and push the grommet into the cable-routing hole of the weather-resistant enclosure.

Figure 137: Installing the Transceiver

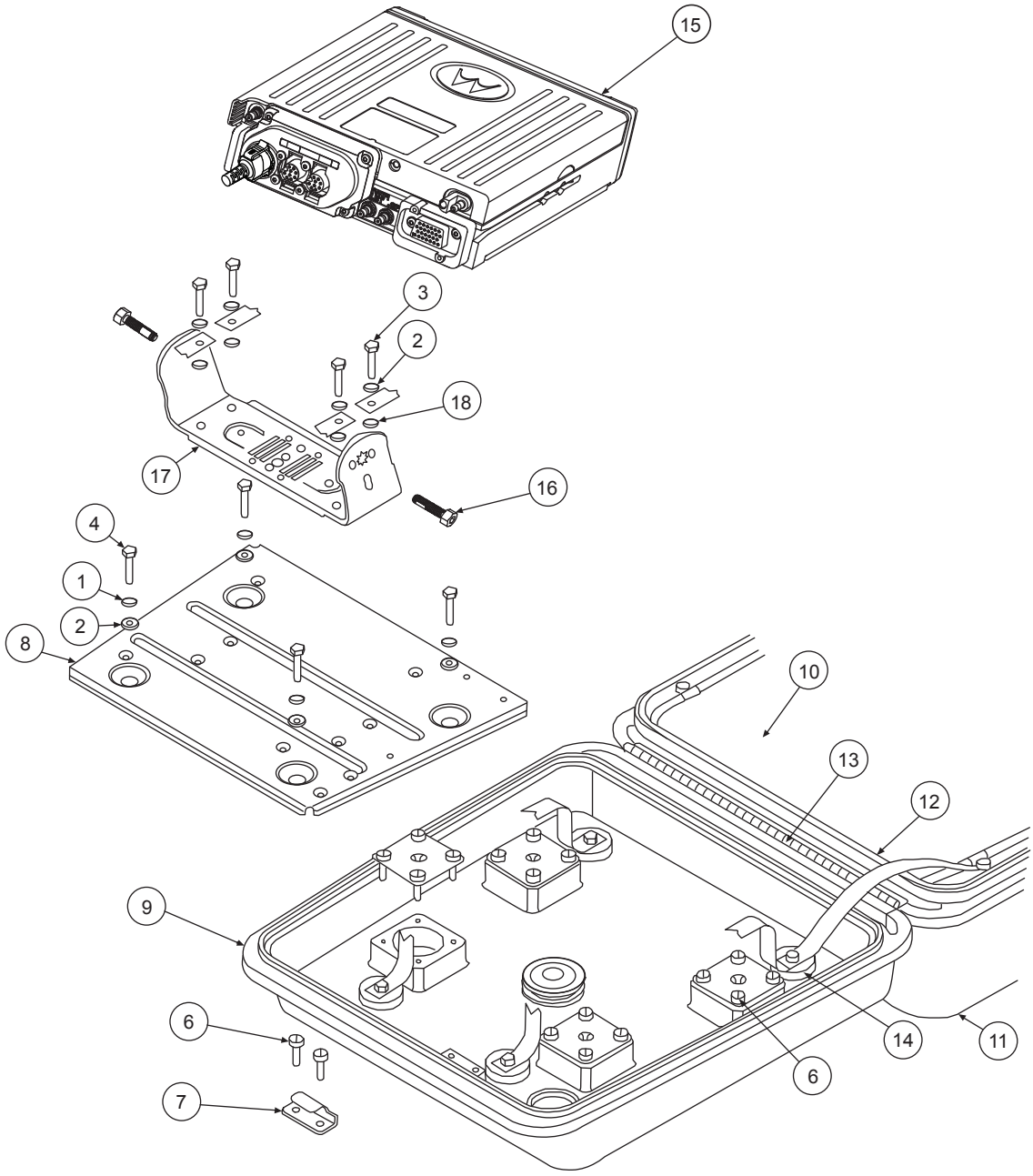


Table 16: Transceiver Installation Parts List

No.	Description
1	Lock washer
2	Flat washer (8 used)
3	Screw
4	Screw
5	Grommet

No.	Description
6	Screw
7	Lock catch
8	Radio mounting plate
9	Bottom housing
10	Ground shield plane
11	Top cover
12	Gasket
13	Hinge
14	Enclosure mounts
15	Transceiver
16	Screw
17	Trunnion
18	External tooth lock washer (8 used)

5.12
Installing the Emergency Switch Option

Use the two-conductor, green/black cable which has one end terminated with two contacts that is supplied with the HLN5131_ Emergency Push Button.

Disconnect the emergency switch shorting plug from the accessory cable. Replace the shorting wire of the shorting plug with the terminated end of the green/black emergency cable. Reconnect the plug to the accessory cable.

5.13
Installing the External Alarm Relay Option

The motorcycle radio is offered with only one optional relay connection. If both horn and lights are required, wire a second relay coil parallel to the first relay. Use the two-conductor green/black cable which has one end terminated with two contacts that is supplied with the W116 Emergency Push Button. Insert the contacts into positions 3 and 4 of the emergency shorting plug of the accessory cable. Refer to Figure 143: Horn/Lights Wiring Diagram on page 137.

5.14
Installing the Headset Accessory

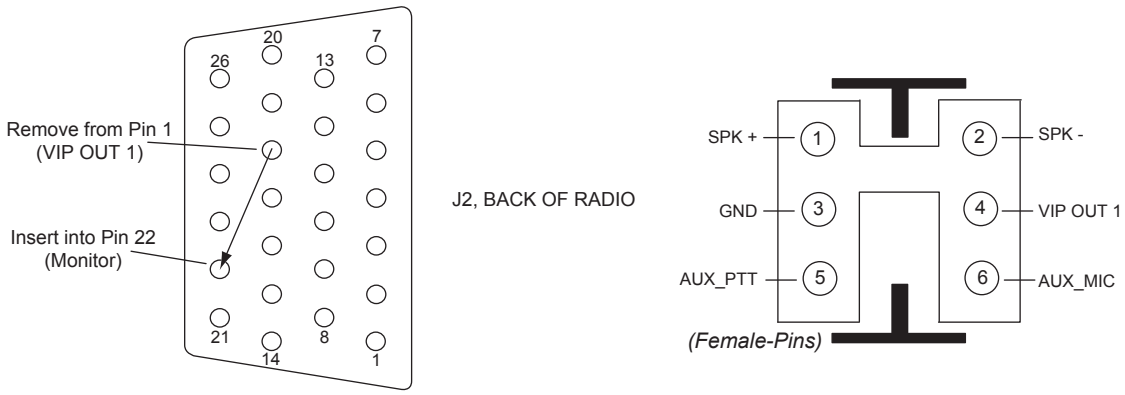
A six-position connector on the accessory cable has been made available for connecting a headset accessory.

Consult a headset manufacturer for compatibility with the motorcycle radio. This can be done before the purchase and installation of the headset.

To install, disconnect the headset shorting plug. Remove the headset shorting wire from the headset shorting plug. Terminate the contacts provided to the applicable wires of the headset cable. Insert the terminated wires into the headset shorting plug (as illustrated in the typical headset schematic found in this manual). Reconnect the terminated headset shorting plug to the accessory cable.

When upgrading from a mobile radio, the existing headset cable HLN6890 requires these two pins to be swapped. The other motorcycle headset cable with this pin change is 3080010R07.

Figure 138: Motorcycle Wiring Harness Rework



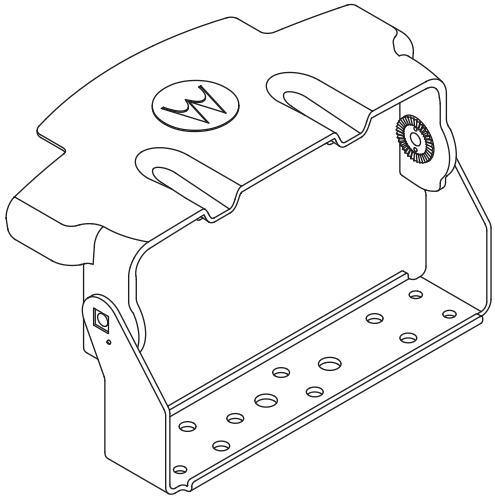
5.15 Installing the O5 and E5 Control Head Sunshield

Follow the procedure to install the sunshield (part number NNTN7279_) to the O5 and E5 control head.

Procedure:

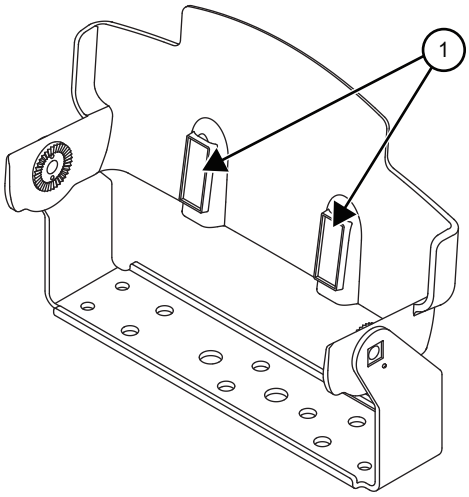
1. Assemble the sunshield to the remote mount trunnion. The same process can be used for the motorcycle trunnion.

   Figure 139: Remote Mount Trunnion with Sunshield

2. Position the sunshield and remove the Velcro adhesive backing.

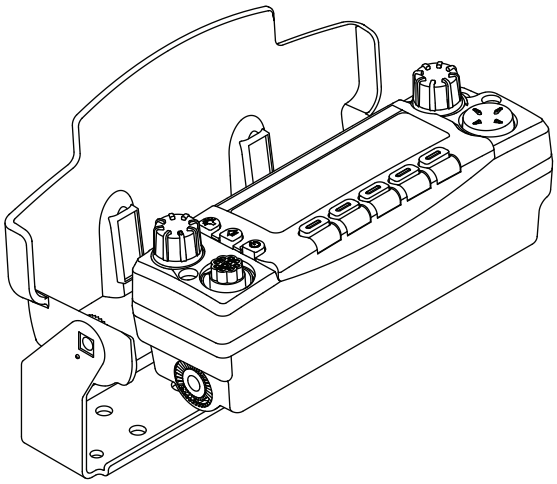
Figure 140: Position the Sunshield



No.	Description
1	Velcro Adhesive Backing

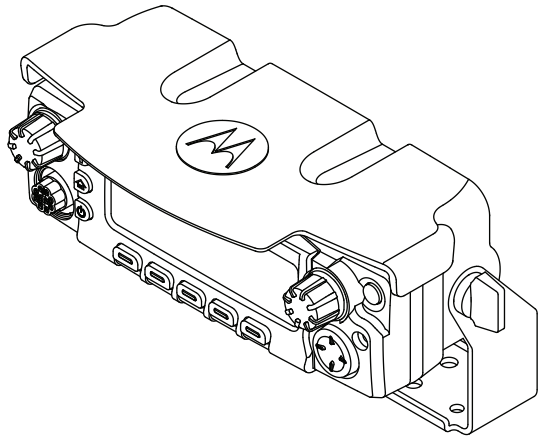
3. Slide the control head onto the trunnion while aligning the edge of the control head with the edge of the sunshield. Make sure the Velcro properly adheres to the control head.

Figure 141: Slide the Control Head onto Trunnion



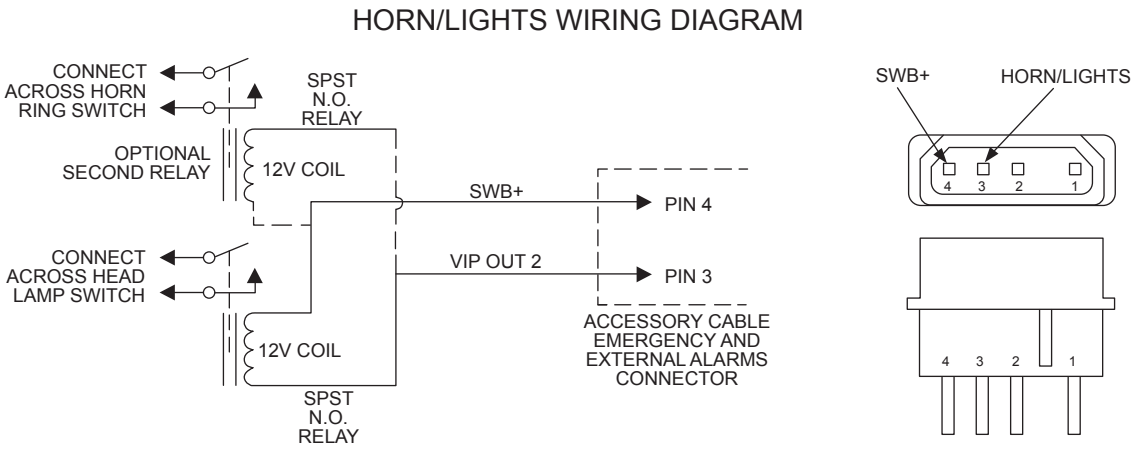
4. Position control head as desired and install screws.

Figure 142: Position Control Head as Desired



5.16 Horn/Lights Wiring

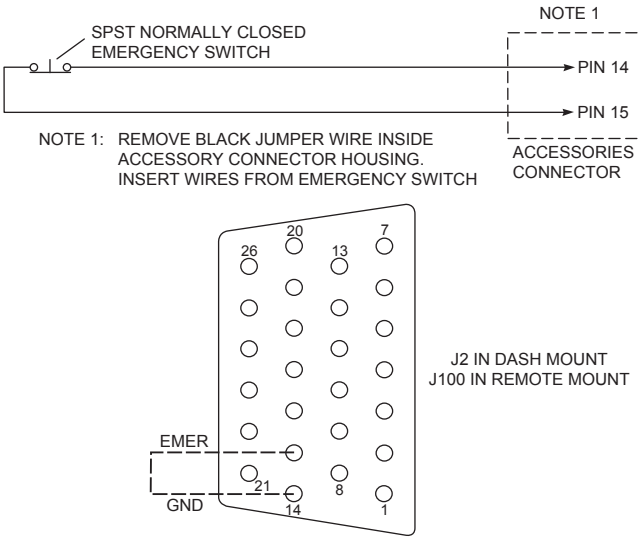
Figure 143: Horn/Lights Wiring Diagram



5.17

Emergency Switch Wiring

Figure 144: Emergency Switch Wiring Diagram



WARNING: Motorcycle products must have pins 1 and 2 connected together to allow the radio to power down. Opening this connection by removing the emergency shorting plug, or pressing the emergency switch, will turn on the radio. Failure to maintain a normally-closed path could drain the vehicle battery if left unchecked.

Emergency-equipped radios are capable of transmitting without warning.

Chapter 6

Finishing the Installation

This chapter provides the installation procedure for cable connection and dust cover.

6.1 Cable Connection

The topic provides the procedure for control heads cable connection.

6.1.1 Connecting the Cables for O2 Control Head

Procedure:

1. Remove the control head from its mounting trunnion.
2. Plug the radio CAN cable into the proper location on the back of the control head (see Figure 57: O5 Control Head Installation Exploded View (Also applicable for O2, O7 and E5 Control Heads) on page 55 and Figure 59: O5 Control Head Rear View (Also applicable for O2 and O7 Control Heads) on page 57).

   The connectors “click” when snapped into place. The control head model can have the microphone plugged into the lower left corner of the control head front panel.
3. Connect the plug from the speaker lead to the mating connector that comes out from the power cable.
4. Plug the VIP connector into the correct location an the back of the control head.
5. Connect the CAN cable to the proper location on the radio.

   NOTE: Connector-protective covers are provided with the radio. They should be used for added environmental robustness.
6. Ensure that the control head and microphone PTT switches are turned off.
7. Install the 15 A fuse in the radio power cable fuseholder and the 3 A or 4 A fuse in the ignition sense cable fuseholder.
8. Turn on the radio at the control head and verify proper operation of all controls and indicators.

   Radio operation in some installations requires turning on the ignition sense.
9. Perform a complete operational check of the radio.
10. Dress the control and power cables out of the way to prevent damage (pull any excess cable into the trunk area), securing the cables with clamps and tie wraps where necessary.

6.1.2 Connecting the Cables for O3 Control Head

Procedure:

1. Unplug the CAN coiled cable connector from the Transceiver Interface.

2. Plug in the connector again.

   You hear a click sound.

3. Ensure that the location of the CAN connector is correct (such as J800L or J800R) on the transceiver interface.
4. Connect the plug from the speaker lead to the mating connector of J2.

6.1.3
Connecting the Cables for O5, E5 and O7 Control Heads

Procedure:

1. Remove the control head from its mounting trunnion.
2. Plug the radio CAN cable into the proper location on the back of the control head (see Figure 57: O5 Control Head Installation Exploded View (Also applicable for O2, O7 and E5 Control Heads) on page 55 and Figure 59: O5 Control Head Rear View (Also applicable for O2 and O7 Control Heads) on page 57).

   The connectors “click” when snapped into place. The control head model can have the microphone plugged into the lower left corner of the control head front panel.

3. Connect the plug from the speaker lead to the mating connector that comes out from the power cable.
4. Plug the VIP connector into the correct location at the back of the control head.
5. Connect the CAN cable to the proper location on the radio.

6.1.4
Connecting the Cables for O9 Control Head

Perform the following if it has not been previously done:

Procedure:

1. Remove the control head from its mounting trunnion.
2. Plug the radio CAN cable into the proper location on the back of the control head (see Figure 58: O9 Control Head Installation Exploded View on page 56 and Figure 61: O9 Control Head Rear View on page 57).

   The connectors “click” when snapped into place. The control head model can have the microphone plugged into the GCAI connection on the control head back panel.

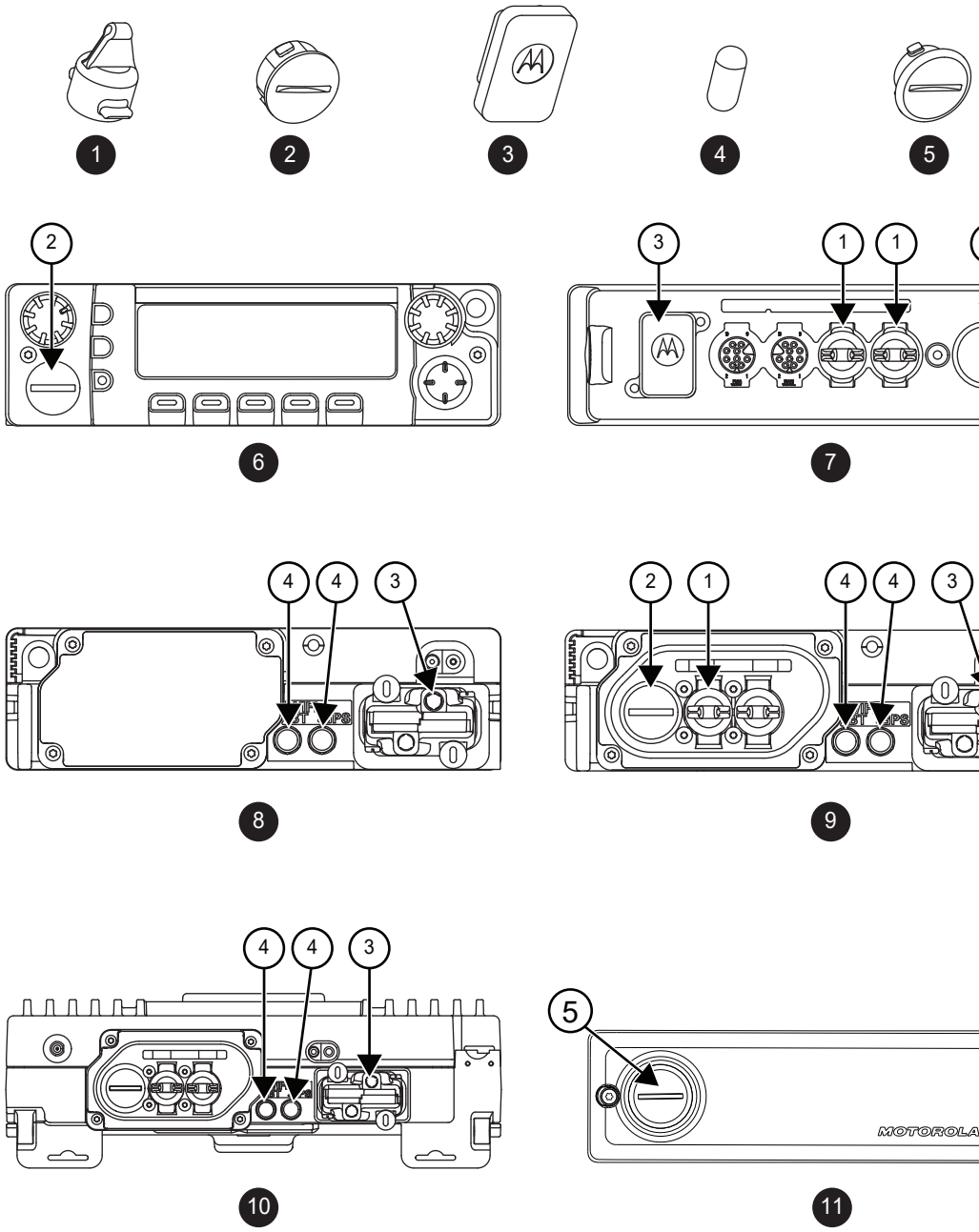
3. Connect the plug from the speaker lead to the mating connector that comes out from the power cable.
4. Plug the VIP connector into the correct location at the back of the control head.
5. Connect the CAN cable to the proper location on the radio.

6.2
Dust Cover Installation

To help protect and ensure that debris does not affect or damage your unused connectors, use the provided dust covers.

Refer to the following figure to determine the correct cover for your connector.

Figure 145: Dust Cover Installation Locations



No.	Description
1	1515047C01
2	1515048C01
3	7575262A01
4	SL000319A01
5	1515327H02
6	Control Head

No.	Description
7	Control Head Remote (Rear)
8	APX 8500 Mid Power-Rear (with no TIB/Dash Mount)
9	APX 8500 Mid Power-Rear (with TIB/Remote Mount)
10	APX 8500 High Power-Rear (with TIB/Remote Mount)
11	APX 8500 Mid Power Ethernet Faceplate

NOTE:
Using a coin as a tool, parts 2 and 5 require you to insert then turn the coin approximately 1/3 turn until snug.

Install part 3 onto DB25 accessory cable assembly when the corresponding cable assembly connections are not in use.

Chapter 7

Best Practices: Installation and Troubleshooting

This chapter covers the Motorola Solutions recommended vehicle installation practices that can address or prevent many issues.

- Radio circuit damage due to overvoltage condition.
- Radio/Accessories "lock-up".
- Radio/Accessories change state/lock-up when radio PTT is depressed.
- Radio powers up in the FL 01/90 state (general communication error code).
- Radio intermittently resets.
- Radio loses secure key.
- Transmit audio distortion on motorcycle radio when engine is running.
- Keypad buttons become inoperative for motorcycle radios when engine is running.
- Alternator whines when transmitting with engine running.
- Radio/Accessories turn themselves on or off.

7.1 Checking the Wiring of Ignition and Radio Ignition Sensing

- If it is required to turn the radio on and off using the ignition sense switch, in addition to the control head on/off switch, connect the ignition sense lead to the accessory terminal from the ignition switch (usually in the vehicle fuse panel under accessory or radio).

  NOTE: Motorola Solutions recommends protecting or isolating the radio ignition sense input from voltage spikes more than +/- 40 VDC. Such spikes can be hundreds of volts in amplitude and are common in larger vehicles (for example utility trucks and buses), especially when the source is common to a solenoid coil. A triggerable oscilloscope is required to determine the existence of such spikes as most voltmeters cannot measure in short duration (< 1 ms). If the condition of the intended ignition sense source is unknown, Motorola Solutions recommends isolating the source from the radio with a relay or the use of a suppression diode wired between the source and ground. Any high current suppression diode (MR2535) with a breakdown voltage of between 18 V and 40 V would suffice. A suitable diode kit is available from Motorola Solutions parts, kit number HLN6325_.

- If it is required to have the radio power up only using the control head on/off switch, then connect the ignition sense lead directly to the positive terminal of the battery. The ignition sense will always be ignored and a re-wiring is necessary in the future if the operator chooses any ignition sense CPS setting.

7.2
Checking the Physical Installation of Radio Ground and Radio Accessory Wiring

Dash and Remote Mount Configurations

- Scrape away paint on the chassis at the place where you are making the ground connection, and try to keep the ground lead as short as possible.
- Verify that the red A+ lead is connected directly to the positive terminal of the battery and the black ground lead is connected to the vehicle chassis using a wire with practical length.
- Ensure that the mobile radio antenna is the minimum required distance (three feet) from the mobile radio equipment to prevent radio frequency interference (RFI).
- For vehicles that have other types of electronic equipment installed such as lights, flashers, computers, siren/PA, and others, use a separate ground for the mobile radio equipment.
- Do not coil up any excess length of the red A+ lead. Doing this may produce a large transient voltage when there is a high current drain for example, during transmit. This could cause the radio to reset when the push-to-talk (PTT) is depressed.

Motorcycle Configuration

- Ensure that the antenna ground connection is solid. An intermittent ground connection can distort the transmission when the motorcycle engine is running.
- Do not coil up any excessive length of antenna cable. It may affect the receive performance of the radio.
- If an extra length of cable is used to extend the microphone, ensure that the added capacitance does not interfere with the operation of the radio.

NOTE:
Some vehicles have dedicated ground points. If available, use the ground points for the radio ground connection.

If multiple radios or antennas are installed, ensure that the minimum antenna separation requirements are met.

7.3
Improving the Electrical Quality of the Power and Ignition Lines

- Use a relay to isolate the vehicle ignition switch point (ACC) from the radio ignition sense point. Control this relay from the vehicle ignition switch point (ACC). Supply a cleaner voltage from the positive terminal of the battery into the relay, which will now be attached to the radio ignition sense point. Now the ACC line toggles the relay, instead of directly toggling the radios ignition sense line.
- Install a Power Line Filter between the A+ lead and the positive terminal of the battery. The Power Line Filter filters the battery power applied to the transmitter power amplifiers. Pay extra caution to this because the series filter introduces a negative spike when the radio transmits that may cause problems with radio operation.
- For vehicles that use electromechanical relays to control external devices (lights, motors, switch boxes, and others), isolate these relay circuits as best as possible from the mobile radio equipment. Also, use diode suppression across the relay coil to minimize the noise produced by the collapsing magnetic field.

- If the ignition sense switch is used, ensure that there is not a large voltage drop between the A+ point (usually the positive terminal of the battery) and the ignition sense point. In general, the voltage difference between these two points, should not be greater than 1.5 V when all accessories/air-conditioner are turned on. Refer to the *Basic Service Manual* for specifications for minimum and maximum voltage levels. Typical battery voltage levels are 13.6 V +/- 20%.

7.4 Minimizing the Effect of Poorly Grounded Antennas

For vehicles with high power radios that use glass mount antennas, keep the radio and antenna cable as far as possible from the radiating element of the antenna. If a sufficient distance is not maintained, the lack of a proper ground plane from the glass mount antenna may cause the radio transmit signal to interfere with itself and cause a reset. To minimize this effect, it may be necessary to install ferrite beads on the antenna cable to protect the radio from this interference.

7.5 Jump-Starting the Vehicle

Prerequisites:

CAUTION: Do not jump-start vehicles with radio power or ignition sense cables connected. Damage to the radio and/or accessories may result.

Jump-starting a vehicle can crank 300+ volts through the vehicle charging system and these transients can damage electrical equipment.

The state of your radio before it needs a jump-start may be unknown, and the radio may attempt to return to its last state (radio ON), when doing a jump-start. Therefore, carry out the following procedure before jump-starting any vehicle containing a radio.

Procedure:

1. Locate the ignition sense line (thin yellow wire or thin red wire, depending on dash mount or remote mount installation) and the main power leads (thick red wire) near the battery positive terminal.

   NOTE:
   These lines are fused. In the event these lines are not fused (add the appropriate fuse in line), use whatever tools necessary to physically disconnect the ignition sense and power lines from the battery terminal.

   Ensure that the disconnected lines are not in the way of moving motorcycle parts or interfering with the motorcycle operation in any way.
2. Open up the fuse holders and remove the fuses out of the kits.
3. Re-tighten the fuse holders but without the fuses to ensure that ignition sense and power lines do not interfere with moving motorcycle parts.
4. Proceed with the jump-start routine as described in the manual of your vehicle.
5. Once the jump-start process is complete, re-install the fuses into their holders.

7.6 Eliminating Noise/Howling from PA Speaker

- Refer to Installation Examples for recommended methods available to the mobile two-way radio, with accessories placed to the vehicle.

- Refer to Figure 13, Figure 14, and Figure 15 for the wiring diagrams for the recommended configurations.
- Refer to the *Siren/PA User Manual* for further details on lowering the wattage.

Appendix A

Replacement Parts Ordering

Some replacement parts, spare parts, and/or product information can be ordered directly from the Motorola Solutions local distribution organization or through Motorola Online.

Basic Ordering Information

While parts may be assigned with a Motorola Solutions part number, they may not be available from the Motorola Solutions Radio Products and Solutions Organization (RPSO).

NOTE: RPSO was formerly known as the Radio Products Services Division (RPSD) and/or the Accessories and Aftermarket Division (AAD).

Some parts may have become obsolete and are no longer available in the market due to cancellations by the supplier. If no Motorola Solutions part number is assigned, the part is normally not available from Motorola Solutions, or is not a user-serviceable part. Part numbers appended with an asterisk are serviceable by Motorola Solutions Depot only.

Place orders for replacement parts, kits, and assemblies directly on Motorola Solutions local distribution organization or through Motorola Online. When ordering replacement parts or equipment information, include the complete identification number. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part of, and sufficient description of the desired component to identify it.

To identify non-referenced spare parts, request for help from the Customer Care organization of a Motorola Solutions local area representative.

Motorola Solutions Service and Support

For customer service call, 1-888-325-9336. Available from Monday to Friday, 8:00 AM to 5:00 PM (Central Standard Time).

The product catalog is available on the Motorola Online website. To register for login access:

- For APAC and ANZ regions, sign up at https://asiaonline.mot-solutions.com.
- For LACR region, sign up at https://businessonline.motorolasolutions.com.

Types of Orders	Contact Information
Mail Orders Mail orders are only accepted by the U.S. Federal Government Markets Division (USFGMD).	Motorola Solutions 7031 Columbia Gateway Drive 3rd Floor – Order Processing Columbia, MD 21046 U.S.A.
Telephone Orders and Parts Identification	Radio Products and Solutions Organization (RPSO) (United States and Canada) 7:00 AM to 7:00 PM (Central Standard Time) Monday through Friday (Chicago, U.S.A.) 1-847-538-8023 (United States and Canada)
	U.S. Federal Government Markets Division (USFGMD)

Types of Orders	Contact Information
	1-800-826-1913 Federal Government Parts (Credit Cards Only) 8:30 AM to 5:00 PM (Eastern Standard Time)
Fax Orders	Radio Products and Solutions Organization (RPSO) (United States and Canada) 1-800-622-6210 1-847-576-3023 (United States and Canada)
	U.S. Federal Government Markets Division (USFGMD) 1-800-526-8641

Product Customer Service

Radio Products and Solutions Organization (RPSO) (United States and Canada)

1-800-927-2744

A.1
Service Information

Technical & Repair Support (for Contracted Customers Only)

If you would like to contact the Motorola Solutions Customer Care team, use the appropriate contact details below. Please be prepared to provide your contract number, product serial numbers, and detailed issue description for a faster response and a resolution. If the support request is Technical Support related, the request will be handled by the Technical Support Operations (TSO) team. This team of highly skilled professionals provides Technical Support to help resolve technical issues and quickly restore networks and systems. If you are unsure whether your current service agreement entitles you to benefit from this service, or if you would like more information about the Technical or Repair Support Services, contact your local customer support or account manager for further information.

Contact Details

Technical Requests: techsupport.emea@motorolasolutions.com

Repair Support: repair.emea@motorolasolutions.com

Contact Us: https://www.motorolasolutions.com/en_xu/support.html

Parts Identification and Ordering

If you need help with identifying non-referenced spare parts, direct a request to the Customer Care Organization of a local area Motorola Solutions representative. Orders for replacement parts, kits, and assemblies should be placed directly at the local distribution organization of Motorola Solutions.

A.2
Service Information for APAC

This topic contains contact details to service centers in the Asia and Pacific region.

Technical Support

Technical support is available to assist the dealer or distributor in resolving any malfunction, which may be encountered. Initial contact must be by telephone wherever possible. When contacting Motorola Solutions Technical Support, be prepared to provide the product model number and the serial number.

Further Assistance From Motorola Solutions

You can also contact the Customer Help Desk through the website: http://www.motorolasolutions.com/en_xp/products. If a unit requires further complete testing, knowledge, details, or both of component level troubleshooting or service than is customarily performed at the basic level, send your radio to a Motorola Solutions Service Center as listed in the following table:

Table 17: Service Information – Telephone Numbers and Addresses of the Asia and Pacific Motorola Solutions Centers

Country	Telephone Number	Address
Singapore	+65-6352-6383	**Motorola Solutions Singapore Pte. Ltd,** c/o Azure Engineering, 49 Jalan Pemimpin, #03-11 APS Industrial Building, Singapore 577203 Contact: Alvin Tan E-mail: alvin.tan@motorolasolutions.com Contact: Gan Saw See E-mail: gan.sawsee@motorolasolutions.com
Malaysia	+603-7809-0000	**Motorola Solutions Sdn. Bhd.** Level 14, Persoft Tower, No. 68, Pesiaran Tropicana, 47410 Petaling Jaya, Selangor Darul Ehsan, Malaysia Contact: Koh Tiong Eng E-mail: A21001@motorolasolutions.com
Indonesia	+62-21-3043-5239	**PT. Motorola Solutions Indonesia** 30th Floor, Gedung BRI II, Suite 3001, Jl. Jend. Sudirman Kav. 44-46, Jakarta 10210, Indonesia Contact: Eko Haryanto E-mail: Eko.Haryanto@motorolasolutions.com
Thailand	Tel: +662-653-220 Fax: +668-254-5922	**Motorola Solutions (Thailand) Ltd.** 142 Two Pacific Place Suite 2201, 3220 Sukhumvit Road, Klongtoey, Bangkok 10110 Contact: Nitas Vatanasupapon E-mail: Nitas@motorolasolutions.com
India	+91-9844218850	**Motorola Solutions India Pvt. Ltd.**

Country	Telephone Number	Address
		C/o Communication Test Design India Private Limited, #4, 5 Maruthi Industrial Estate, Rajapalya, Hoodi Village, Bangalore - 560048, India Contact: K. Umamaheswari E-mail: umamaheshwari@motorolasolutions.com
China	+86-10-8473-5128	**Motorola Solutions (China) Co. Ltd.** No. 1 Wang Jing East Road, Chao Yang District, Beijing, 100102, P.R. China Contact: Sophy Wang E-mail: C18170@motorolasolutions.com
Hong Kong	852-2966-4823	**Motorola Solutions Asia Pacific Ltd.** Unit 1807-1812, 18/F, Two Harbourfront, 22 Tak Fung Street, Hunghom, Kowloon, Hong Kong Contact: Judy Leung E-mail: Judy.Leung@motorolasolutions.com
Philippines	Tel: +632 858-7500 Fax: +632 841-0681	**Motorola Communications Philippines, Inc.** Unit 2102, One Global Place Building, 5th Ave., Bonifacio Global City, Taguig, Philippines 1634. Contact: Arthur Nieves E-mail: Arthur.Nieves@motorolasolutions.com
Korea	+822-3497-3649	**Motorola Solutions Korea, Inc.** 9th Floor, Hibrand Building, 215, Yangjae-Dong, Seocho-Gu, Seoul, 137-924, Korea. Contact: KS Kwak E-mail: r45321@motorolasolutions.com
Taiwan	+886-2-8729 8000	**Motorola Solutions Taiwan, Ltd.** 8F, No. 9, Songgao Rd., Taipei 110, Taiwan (R.O.C.) Contact: Michael Chou E-mail: ftpe239@motorolasolutions.com
Australia	+613-9847-7725	**Motorola Solutions Australia Pty. Ltd.** 10 Wesley Court, Tally Ho Business Park, East Burwood Victoria 3151,

Country	Telephone Number	Address
		Australia. E-mail: servicecentre.au@motorolasolutions.com

Piece Parts

Some replacement parts, spare parts, product information, or all can be ordered directly. If a complete Motorola Solutions part number is assigned to the part, the part is available from the Motorola Solutions Service Organization. If no part number is assigned, the part is not normally available from Motorola Solutions. If a list of parts is not included, that means no user-serviceable parts are available for that kit or assembly.

Customer Programming Software has no capability to tune your radio. Tuning your radio can only be performed at the factory or at the appropriate Motorola Solutions Repair Center. Component replacement can affect your radio tuning and must only be performed by the appropriate Motorola Solutions Repair Center.

All orders for parts or information must include the complete Motorola Solutions identification number. All part orders must be directed to your local Motorola Solutions Service Organization. See your latest price pages.

Parts Identification and Ordering

Request for help in identification of nonreferenced spare parts must be directed to the Customer Care Organization of Motorola Solutions local area representation. Orders for replacement parts, kits, and assemblies must be placed directly on a Motorola Solutions local distribution organization.

Glossary

This glossary contains an alphabetical listing of terms and their definitions that are applicable to portable and mobile subscriber radio products.

Analog
Refers to a continuously variable signal or a circuit or device designed to handle such signals.

Band
Frequencies allowed for a specific purpose.

Customer Programming Software
CPS-Software with a graphical user interface containing the feature set of an ASTRO radio.

Default
A pre-defined set of parameters.

DEK
Direct Entry Keyboard

digital
Refers to data that is stored or transmitted as a sequence of discrete symbols from a finite set; most commonly this means binary data represented using electronic or electromagnetic signals.

FCC
Federal Communications Commission.

Firmware
Code executed by an embedded processor such as the Host or DSP in a subscriber radio. This type of code is typically resident in non-volatile memory and as such is more difficult to change than code executed from RAM.

Frequency
Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).

GLONASS
GLObalnaya NAvigatsionnaya Sputnikovaya Sistema, The Russian Global Navigation satellite system: Consisting of at least 24 operational satellites which fly in medium Earth orbit at an altitude of approximately 19,130 km. Each satellite circles the Earth slightly faster than twice a day. GLONASS provides Time and Location to anywhere on Earth, where there is an unobstructed line of sight to four or more GPS satellites. A GLONASS receiver triangulates its position using these satellites.

GNSS
Global Navigation Satellite System

GPS
Global Positioning System

Kilohertz (kHz)
One thousand cycles per second. Used especially as a radio-frequency unit.

Megahertz (MHz)
One million cycles per second. Used especially as a radio-frequency unit.

Microcontroller Unit (MCU)
MCU-Also written as µC. A microprocessor that contains RAM and ROM components, as well as communications and programming components and peripherals.

PA
Power amplifier.

Paging
One-way communication that alerts the receiver to retrieve a message.

Push-to-Talk
PTT-The switch or button usually located on the left side of the radio which, when pressed, causes the radio to transmit. When the PTT is released, the unit returns to receive operation.

Radio Frequency
RF-The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).

Receiver
Electronic device that amplifies RF signals. A receiver separates the audio signal from the RF carrier, amplifies it, and converts it back to the original sound waves.

Registers
Short-term data-storage circuits within the microcontroller unit or programmable logic IC.

RESET
Reset line: an input to the microcontroller that restarts execution.

Receiver
Electronic device that amplifies RF signals. A receiver separates the audio signal from the RF carrier, amplifies it, and converts it back to the original sound waves.

Signal
An electrically transmitted electromagnetic wave.

Software
Computer programs, procedures, rules, documentation, and data pertaining to the operation of a system.

Time-out Timer
TOT-A timer that limits the length of a transmission.

Transceiver
Transmitter-receiver. A device that both transmits and receives analog or digital signals. Also abbreviated as XCVR.

Transmitter
Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.

TX
Transmit.

UHF
Ultra-High Frequency.

Universal Serial Bus (USB)
An external bus standard that supports data transfer rates of 480 Mbps.

VHF
Very-High Frequency.

Waypoint
Geographic Coordinates of a specific location. It can also be an Intermediate point on a route or line of travel.

Wi-Fi
Wireless Data Transmission protocol 802.11.